22 JUNE 1979 (FOUO 22/79) 1 OF 1

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JPRS L/8533

22 June 1979

USSR

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY

BIOMEDICAL AND BEHAVIORAL SCIENCES

(FOUO 22/79)

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TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY

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CONTENTS PAGE

CONTENTS (Continued) Page

AGROTECHNOLOGY

APPLICATIONS FOR AUTHORSHIP CERTIFICATION ON NEW CROP VARIETIES

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 2, 1979 pp i-ii

[Text] The USSR Ministry of Agriculture State Commission for Varieties Testing of Farm Crops announces that it has received applications for recognition of authorship of farm crop varieties from the following scientific-research institutions and selective breeders:

1. The Krasnodar Scientific-Research Institute of Agriculture and selective breeders Yuriy Mikhaylovich Puchkov, Lyudmila Andreyevna Bespalova, Anatoliy Yakovlevich Volkov, Lyubov' Vasil'yevna Sushko, Vitaliy Vasil'yevich Kostin, Nadezhda Dmitriyevna Tarasenko, Anastasiy Aleksandrovna Voronkova, also the institute's petition to award authorship posthumously to selective breeder Pavel Panteleymonovich Luk'yanenko, for winter wheat variety Polukarlikovaya-49; Mikhail Ivanovich Khadzhinov, Aleksandr Fedorovich Kazankov, Emiliya Isayevna Vakhrusheva, Alla Borisovna Smirnova, and Nina Vasil'yevna Zakharova for corn hybrids Krasnodarskiy-229 TV and Krasnodarskiy-332 TV; Vera Andreyevna Yevus and Anatoliy Alekseyevich Yanchenko for corn hybrid Krasnodarskiy-229 TV; North Caucasus Scientific-Research Institute of Agriculture and selective breeder Lidiya Antonovna Golik for corn hybrid Krasnodarskiy-332 TV.

2. Chernigovsk Agricultural Experimental Station and selective breeders Vasiliy Sergeyevich Gubernator, Lidiya Ivanovna Kolomiyets, and Yuriy Terent'yevich Lutay for spring barley variety Nosovskiy-9.

3. All-Union Scientific-Research Institute for Corn, Sinel'nikovo Experimental Selection Station, and selective breeders Andrey Mitrofanovich Mironenko and Vladimir Il'ich Stin'ko for spring barley variety Dneprovskiy-220.

4. Kirgiz Scientific-Research Institute of Land Cultivation and selective breeders Mikhail Grigor'yevich Tovstik, Sergey Mikhaylovich Yefimenko, and Sof'ya Prokhorovna Katkova for winter wheat variety Eritrospermum-80.

5. Transcarpathian Agricultural Experimental Station, USSR Academy of Sciences Siberian Department Institute of Cytology and Genetics, and selective breeders Anna Ivanovna Dzhevzhik, Vadim Borisovich Yenken, and Aleksandr Yanovich Aly for feed soy variety Beregovchanka.

6. Belaya Tserkov' Experimental Selection Station and selective breeders Valeriy Ivanovich Sidorchuk, Vladimir Grigor'yevich Gerasimenko, and Nataliya Pavlovna Lishenko for spring vetch variety Belotserkovskaya-623.

7. Scientific-Research Institute of Agriculture of the Central Regions of the Nonchernozem Zone and selective breeders Engel' Danilovich Nettevich, Anatoliy Vasil'yevich Sergeyev, and Yevgeniy Vasil'yevich Lyzlov for spring oats variety Ruslan.

8. Krasnoyarsk Scientific-Research Institute of Agriculture and VIR [All-Union Scientific-Research Institute of Plant Husbandry] and selective breeders Nikolay Aleksandrovich Surin, Nadezhda Yevgen'yevna Lyakhova, and Aleksandra Yakovlevna Trofimovskaya for spring barley variety Rassvet.

9. Karabalyk Agricultural Experimental Station and selective breeders Lidiya Vasil'yevna Pimenova, Vladimir Filippovich Mashtakov, Ivan Aleksandrovich Saurmel'kh, Asya Vasil'yevna Martynova, and Anatoliy Aleksandrovich Gryaznov for spring wheat variety Lyutestsens-57.

10. Kirov Agricultural Institute and selective breeders Vasiliy Grigor'yevich Smirnov, Lyudmila Konstantinovna Kotel'nikova, Yevgeniy Yegorovich Ozhegov, Vasiliy Andrianovich Starostin, and Lidiya Ivanovna Titova for winter rye variety Vyatka Severnaya.

11. All-Union Selection and Genetics Institute and selective breeders Petr Fedorovich Klyuchko, Adol'f Leonidovich Petrenko, Aleksandr Samsonovich Musiyko, Ol'ga Petrovna Koval', Vladimir Alekseyevich Serikov, and Inna Nikolayevna Prokopovich for corn hybrid Vazhnyy.

12. Verkhnyachka Experimental Selection Station and selective breeders Nikolay Stepanovich Gritsyk, Vitaliy Yermolayevich Palamarchuk, Vladimir Nikolayevich Voloshin, Nikolay Danilovich Tsvynda, also the institute's petition to award authorship posthumously to selective breeder Tit Fedorovich Grin'ko, for sugar beet variety Verkhnyachskiy Poligibrid-26.

13. All-Russian Scientific-Research Institute of Sugar Beets and Sugar and selective breeders Aydyn Mikail-ogly Yusubov, Nina Romanovna Mosina, Ivan Fedorovich Golev, and a petition to award authorship posthumously to Avedikt Luk'yanovich Mazlumov, for sugar beet variety Ramonskaya Odnosemyannaya-32.

14. Veselopodolyansk Experimental Selection Station and selective breeders Mikhail Ivanovich Zhigaylo, Petr Petrovich Datsenko, and Andrey Nikolayevich Zagrivoy for sugar beet variety Veselopodolyanskaya Odnosemyannaya-29.

15. All-Union Scientific-Research Institute of Tobacco and Makhorka and selective breeders Tamara Zinov'yevna Ivanova for tobacco variety Ostrolist-451; Valentina Ivanovna Kozlova for tobacco varieties Yubileynyy and Ostrolist Oktyabr'skiy, also the institute's petition to award authorship posthumously to selective breeder Viktor Nikolayevich Kosmodem'yanskiy for tobacco varieties Yubileynyy and Ostrolist-451 and Tamara Alekseyevna Tleush for tobacco varieties Yubileynyy and Ostrolist Oktyabr'skiy.

16. Sarny Scientific-Research Institute Station for Swamp Reclamation and selective breeders Boris Ivanovich Dem'yanchik, Leonid Vasil'yevich Sushitskiy, and Larisa Vladimirovna Potapovich for meadow fescue variety Sarnenskaya.

17. Uzbek Scientific-Research Institute for Grain and selective breeders Dmitriy Petrovich Baygulov, Petr Petrovich Oleynik, Karim Kamilovich Kamilov, Gafur Atabayev, Aleksandr Ivanovich Kovalev, and the institute's petition to award authorship posthumously to selective breeders Yadviga Ivanovna Fal'kovskaya and Nikolay Venidiktovich Pokrovskiy for kochia variety Mal'guz rskiy-83.

18. Kiev Scientific-Research Station for Meadow Cultivation and selective breeders Andrey Petrovich Mikitenko and Yelena Alekseyevna Mordovets for alfalfa variety Kiyevskaya Pestrogibridnaya.

19. Verkhnyachka Experimental Selection Station, L'gov Experimental Selection Station, and selective breeders Tamara Kuz'minichna Kosharnaya, Emma Stepanovna Chekhovskaya, Mariya Petrovna Kruk, Leonid Zod'kovich Sikan, Anna Danilovna Ponomarenko, and the institution's petition to award authorship posthumously to selective breeder Stepan Stepanovich Zelenskiy for spring oats variety Cherkasskiy-1.

20. All-Union Scientific-Research Institute for Corn, Sinel'nikovo Experimental-Selection Station, and Genigskaya Experimental Station and selective breeders Nikolay Strateyevich Kalashnik, Anatoliy Romanovich Miroshnichenko, Valentina Ivanovna Aldoshina, and Anatoliy Grigor'yevich Trotsenko for sorghum hybrid Kormovoy-74.

21. Altay Scientific-Research Institute of Land Cultivation and Agricultural Crop Selection, Buryat Agricultural Experimental Station, and selective breeders Klara Petrovna Mironenko, Gennadiy Aleksandrovich Simakov, Fedos'ya Yakovlevna Dudenkova, and Anastasiya Andreyevna Tsepenko for feed pea variety Kormovaya-50.

22. Moldavian Scientific-Research Institute of Irrigated Land Cultivation and Vegetable Farming and selective breeders Tamara Stepanovna Il'yenko, Anastasiya Petrovna Khar'kova, and Nina Nikolayevna Zaginaylo for sweet pepper variety Viktoriya.

23. Sarny Scientific-Research Station for Swamp Reclamation and selective breeders Boris Ivanovich Dem'yanchik, Leonid Vasil'yevich Sushitskiy, and Larisa Vladimirovna Samsonova for meadow timothy variety Sarnenskaya-35.

All organizations and persons having claims or remarks concerning these varieties and hybrids are requested to advise of same within one month of the publication of this announcement. Address: 107139, Moscow, Orlikov per., 1/11, Goskomissiya.

6854
CSO: 1870

AGROTECHNOLOGY

PROBLEMS, PROSPECTS IN SEED BREEDING

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 2, 1979 pp 1-3

[Article by G. I. Larionov, First Deputy Chief of USSR Sortsemprom: "Raise the Level of Seed Breeding Work"]

[Text] Under conditions of intensification of farm production, higher standards are being imposed on varieties and the variety and sowing qualities of the seed. These standards are being met successfully in those republics, krays, and oblasts where in accordance with the CC CPSU and USSR Council of Ministers decree "Measures to Further Improve Selection and Seed Breeding of Grain and Oil Crops and Grasses" (1976) the indicated measures are being implemented without delay with respect to the concentration of seed production on specialized seed raising farms and the construction of complexes and plants to process and store the seeds, as a result of which seed breeding is becoming an independent sector of farm production.

In accordance with the decree, specialized seed raising farms have already been set up locally. This specialization has now launched the conversion to an established procedure for producing variety seeds and supplying them to kolkhozes and sovkhozes that do not produce seeds. Throughout the country as a whole in 1978, for example, specialized seed farms raised about five million tons of high-quality grain and legume grain seeds, met almost 35 percent of the sunflower seed requirements, and produced more than 30 percent of the perennial grass seed of the total production in the country.

Areas planted in new varieties have been substantially expanded. For example, Severodonskaya winter wheat occupied 600,900 hectares in 1978 versus 194,500 in 1977; the respective figures were 239,600 and 172,400 for Krasnodarskaya-46, 204,900 and 42,700 for Sibiryachka-4 spring wheat, 808,200 and 514,200 for Novosibirskaya-67, 352,200 and 89,600 for Moskovskaya-35, 389,500 and 86,900 for Luch spring barley, 661,900 and 209,200 for Nadya, and 650,600 and 389,300 for Krasnoufimskiy-95.

The specialized seed farms in Belorussia are successfully implementing measures to deepen specialization and raise the level of concentration of seed production. Special attention is being paid to these farms in the republic; the necessary conditions are being created for their effective operation. The specialized farms have been exempted from selling commercial grain; they are being allocated 20 percent more material resources than other farms, also the necessary quantity of technical means for planting, crop tending, and harvesting during optimal periods at a high quality level, and their mineral fertilizer, herbicide and chemical needs are being met.

By 1982, the specialized seed farms will be meeting all of the republic's seed requirements for grain, legumes, and grasses. In 1978 they already produced 314,000 tons of grain crop seeds (45 percent of the kolkhoz and sovkhoz requirements), while grass seed farms produced 23,000 tons of perennial grass seed. Grass seed raising stations are operating successfully in all oblasts of the republic; they are provided with a modern material-technical base for processing and storing the grass seed. In 1977-1978, the republic's specialized seed farms built or remodeled grain storage facilities totaling 81,000 tons capacity. The construction of complexes for processing and storing required quantities of grain, legume, and grass seeds is scheduled for completion by 1981.

The work being done in Belorussia to improve seed farming is having a substantial influence on boosting yields of grain and perennial grasses. Despite the bad weather conditions in 1978, the republic's average grain yield was 25.4 quintals per hectare.

Much work on the concentration of seed production on specialized farms on an industrial basis has been done in Oshskaya Oblast (Kirgizia). Specialized farms exclusively are producing grain seeds for kolkhozes and sovkhozes on all planted areas and also bringing the seeds up to first class planting standard and treating them. The farms have built seed-cleaning complexes including ZAV-20 seed-cleaning units, SP-10 seed-cleaning attachments and pneumatic grading tables, also storage facilities, paved lots, laboratories, and weighing and personnel service facilities. Special shops have been built to treat these seeds.

One would think that the accumulated positive experience in organizing the production of seeds on specialized farms and supplying them to the kolkhozes and sovkhozes ought to be diligently adopted in all oblasts and rayons of the republic. But the Kirgiz Ministry of Agriculture is not paying enough attention to this problem; it is not allocating enough funds to the seed farms for the construction of complexes to treat and store these seeds, and it is not providing enough material resources.

There are also serious shortcomings in the organization of grain seed production in Moldavia. On many of the republic's specialized seed farms the structure of the planted areas does not meet the standards for raising seeds on a scientific basis; the material-technical base for seed processing and storage is not being developed fast enough, and mineral fertilizers are not being supplied. The republic's farm agencies must raise the level of seed breeding work and create the necessary conditions for successful operation of the specialized seed farms.

Considerable work has been done to further improve grain and grass seed raising in Armenia. Twelve specialized seed farms have been transferred to the Republic Variety Seed Raising Association, and several more of the best sovkhozes are scheduled to be transferred, so that by 1981 they can meet all of the grain and grass seed requirements of the republic's kolkhozes and sovkhozes. All of the seed farms are given priority in material-technical supply. The results of work in 1978, however, show that the managers and specialists of a number of farms in the association do not have the required sense of responsibility to ensure completion of the stipulated seed sales plan. Thus, the specialized seed farms Tsovak, Shindayr, Arzakan, and Vardablur did not sell grain seeds although they fulfilled the grain production plan. Throughout the republic as a whole, consequently, the seed farms completed only 36 percent of the grain seed sales plan and 27 percent of the perennial grass seed sales plan. Consequently, the stipulated measures with respect to concentrating seed production on specialized farms have not yet been carried out. The republic's Sortsemprom must make a thorough analysis of why the specialized seed farms have failed to complete the seed sales plan and undertake effective measures to improve their performance.

The Ukraine has set up an excellent system for the management of grain, oil crop, and grass seed raising operations. All of the republic's oblasts have organized variety seed raising associations that are fully responsible for the status of seed breeding operations, supplying the kolkhozes and sovkhozes with high-quality seed, and creating the necessary standby and transfer inventories as well as seed reserves in state resources.

All of the seed requirements for the 1979 crop have been provided for, and the seeds are of high planting quality. In the event of resowing of winter crops, the farms have built up adequate standby stocks of high-yield varieties of barley, peas, and other crops. Last year the seed farms and specialized grain reception enterprises successfully completed stipulated targets with respect to procurement of variety seeds for state stocks, making it possible to release the necessary quantities to kolkhozes and sovkhozes of the republic. Substantial volumes of variety seeds of barley, oats, peas, and buckwheat have been sent to other union republics.

The level of concentration of seed production on specialized farms is closely linked to the farms' material-technical base. The scheduled program of construction of complexes for processing and storing grain and grass seeds is at the focus of attention of republic and oblast variety seed enterprises.

Now, each oblast has built and is operating grass seed breeding stations. Last year they procured more than 17,000 tons of high-grade perennial grass seed versus a planned 10,600. The number of grass seed breeding stations, also mechanized lines for processing grass seeds on specialized farms, is to be increased so that by 1981 all grass seed production will be concentrated on specialized farms, and processing will be concentrated in seed breeding stations. Much attention is being focused on planting perennial grass seed plants. At present, the specialists of the variety seed breeding associations and the grass seed breeding stations of the Ukraine are looking into the possibility of preparing grass mixes in the stations for the kolkhozes and sovkhozes, with ballast added to the seeds to ensure uniform sowing of small-seeded species of grasses. The completion of this work will undoubtedly yield substantial effect.

While commenting on the positive work being done in the Ukraine, mention must also be made of serious shortcomings there. The republic's agricultural and procurement agencies have not taken the necessary measures in recent years to complete the stipulated plan of alfalfa seed procurement for state stocks and deliveries into the union fund.

Work is underway on improving the organization of seed breeding in Uzbekistan. A republic production variety seed breeding association has been set up there, with direct jurisdiction over 19 specialized seed farms. In the oblasts, seed breeding work is the responsibility of the oblast variety seed breeding associations. Most of the grain seed requirements of the kolkhozes and sovkhozes will be provided for by the republic association's specialized farms. The concentration of seed production on specialized farms is an objective necessity in this cotton growing republic, where cereal grain crops occupy only small areas on many kolkhozes and sovkhozes. This will make it possible to boost seed breeding to the necessary level and sow seeds of the highest-yield zoned varieties and crops in order to get the maximum yield from each hectare.

However, not enough attention is being paid to the specialized seed farms in the republic. The local agencies are not taking account of the fact that their main task is to produce high-grade seeds. The republic's Gosplan is not yet stipulating capital investments, material-technical resources, and other indicators in national economy plans with respect to the republic production variety seed breeding association. As a result, there is practically no construction underway on seed breeding facilities, and the specialized farms are not meeting targets with respect to seed sales to the kolkhozes and sovkhozes that do not produce seeds, also procurement of perennial grass seeds for state stocks. The lack of the necessary material-technical base for processing and storing seeds is leading to a situation in which only about 30 percent of the grain seed stocks are being brought up to first and second class planting standard, while perennial grass seeds of substandard purity are being sown.

The republic's ministry of agriculture and the oblast administrations of agriculture must focus more attention on the work of the variety seed breeding associations, enhance their role and responsibility for providing kolkhozes and sovkhozes with high-grade seed, and concentrate the production of seeds on specialized farms.

In order to further improve the country's seed breeding effort and convert it to an industrial basis, the variety seed breeding associations will have to focus attention on the construction of complexes for the processing and storing of seeds and on raising the level of concentration of seed production on the specialized farms and in the seed breeding crews and departments of large kolkhozes and sovkhozes. It is necessary to institute direct economic relations between producers and consumers of seeds on the basis of long-term agreements; it is essential to provide the specialized farms with mineral fertilizers, equipment, and means of protecting plants against pests, diseases, and weeds. It is also essential to impose more responsibility on the experimental-production farms of the scientific-research institutions and the training farms of the VUZ's and tekhnikums for the completion of plans of sales of seeds of top reproduction for each crop and variety.

The conversion of seed breeding to an industrial basis is not a short-term measure. For this reason, the farm agencies must be constantly concerned for raising the level of seed breeding work in order to supply the kolkhozes and sovkhozes with high-grade seed from the best zoned and high-potential varieties and hybrids.

It is the duty of all agricultural workers to implement the party's and government's stipulated measures with respect to radically improving the raising of grain, oil crop, and grass seeds.

6854
CSO: 1870

AGROTECHNOLOGY

WHEAT SELECTION WORK AT THE MIRONOVKA INSTITUTE

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 2, 1979 pp 4-8

[Interview with Twice Hero of Socialist Labor Academician V. N. Remeslo, Director, Mironovka Scientific-Research Institute of Wheat Selection and Seed Breeding: "Scientific Advances for Production"]

[Text] Winners in Competition

At the present stage of agricultural development, a major role in boosting crop yields and improving the quality of the products is played by selection and seed breeding, the development and adoption of new, high-yield varieties and hybrids meeting the requirements of intensive land cultivation.

A large contribution toward the resolution of these tasks is being made by collectives of the Mironovka Scientific-Research Institute of Wheat Selection and Seed Breeding and the All-Union Selection-Genetics Institute. Their accomplishments are highly appreciated by the Homeland. For success achieved in All-Union Socialist Competition in 1978 they were awarded the Challenge Red Banners of the CC CPSU, the USSR Council of Ministers, the AUCCTU, and the CC Komsomol.

The work experience of winners in competition is discussed in materials published below.

[Question] Vasiliy Nikolayevich, would you please tell us what contribution is being made by the country's selective breeding centers, in particular your institute, toward implementing the decisions of the July 1978 CC CPSU Plenum, what has resulted from the adoption of new varieties in production?

[Answer] Everyone is aware of the large and responsible tasks in agriculture set forth at the July 1978 CC CPSU Plenum. In the forthcoming 11th Five-Year Plan (1981-1985), average annual gross grain harvests must be boosted to 238 to 243 million tons, and by 1990 to an average of one ton per capita. As CC CPSU General Secretary Comrade L. I. Brezhnev emphasized at the July Plenum, grain production continues to be the shockwork sector of work in agriculture.

Systematic implementation of our party's agrarian policies with regard to intensification of grain farming and the wide adoption of advances in agricultural science made it possible for farm workers to raise a bumper grain crop in 1978 and achieve a record gross harvest in the history of Soviet farming--235 million tons, including more than 120 million tons of winter and spring wheat.

This remarkable victory also embodies the labor of the country's experimental-selection institutions, our selective breeders. We can state confidently that the expansion of areas planted in new, higher-yield, zoned varieties in 1971-1978 resulted in the production of an additional 7.5 to 8 million tons of grain last year.

A substantial contribution toward further boosting grain production was also made by scientists of the Mironovka Scientific-Research Institute of Wheat Selection and Seed Breeding. In the third, shockwork year of the 10th Five-Year Plan our winter wheat varieties Mironovskaya-808, Mironovskaya Yubileynaya, and Il'ichevka occupied 8.2 million hectares or 36 percent of all high-grade plantings of this crop--that is, one out of every three hectares allocated to this crop was planted in varieties of Mironovka selection. In terms of areas planted in winter wheat, our institute is in first place nationwide. Last year, plantings of Mironovka varieties increased by two million hectares over 1977.

At present, Mironovskaya-808 is zoned in 85 oblasts, krays, and republics; Mironovskaya Yubileynaya is zoned in 12 oblasts of the RSFSR and the Ukraine, and Il'ichevka is zoned in 13 oblasts in the Lesostepnaya and Polesskaya zones of the Ukraine. Thanks to the high winter-hardiness, yields, and outstanding technological qualities of grain from Mironovka varieties it has been possible to substantially boost and stabilize grain production in oblasts of the Ukraine's Lesostep' and other areas. Thus, winter wheat grain yields in Kirovogradskaya, Cherkasskaya, and Chernovitskaya oblasts rose considerably, running more than 35 quintals per hectare last year.

Our institute's scientists are constantly seeking new ways to boost winter wheat yields. One way is to develop and adopt more productive varieties for the kolkhozes and sovkhozes. At present, for example, new varieties are undergoing state testing--Mironovskaya-808 Uluchshennaya, Mironovskaya-11, and Mironovskaya-25. In the institute's competitive varieties testing, their yields ran as high as 67 to 83 quintals per hectare during the years of testing. On the varieties testing plots of Cherkasskaya, Vinnitskaya, Ivano-Frankovskaya, Khmel'nitskaya, Ternopol'skaya, Zhitomirskaya, Tambovskaya, Bryanskaya, and other oblasts they surpassed the yields of the zoned varieties by 8 to 12 quintals per hectare. On the Maslovskiy Sovkhoz-Tekhnikum in Mironovskiy Rayon, Kiev Oblast last year 80 hectares planted in Mironovskaya-808 Uluchshennaya each produced 75.1 quintals.

Data from state varieties testing in Cherkasskaya, Zhitomirskaya, Vinnitskaya, Volgogradskaya, and other oblasts testify to the high yields of Mironovskaya-25. Thus, on the Zolotonosha Varieties Testing Plot of Cherkasskaya Oblast in 1978, this variety produced gross yields of 86 quintals per hectare--7 quintals more than the Il'ichevka; on the Korsun'-Shevchenko it produced 75.2--7.2 more than the standard; on the Kalacheyevskiy Varieties Testing Plot in Volgogradskaya Oblast it yielded 85.9 quintals per hectare.

Mironovskaya-25 is also producing high yields under production testing on kolkhozes and sovkhozes. Last year on the Sinyavskiy Sugar Beets Sovkhoz (Rokitnyanskiy Rayon, Kiev Oblast) it produced 71.7 quintals per hectare; On Kolkhoz imeni Chapayev (Tarashchanskiy Rayon) it produced 75.6. This variety is considered promising in Zhitomirskaya Oblast for 1980.

Good test results were also produced with Mironovskaya-11: on the Kalacheyevskiy Varieties Testing Plot in Volgogradskaya Oblast last year the grain yield was 88.2 quintals per hectare.

New varieties of winter wheat surpass earlier zoned varieties not only in terms of yields but also such vital indicators as resistance to lodging and infestation by fungous diseases.

[Question] What new advances in practical selection work have been achieved by your institute's scientists? Would you name varieties of winter and spring wheat and other farm crops that you have developed in recent years and are preparing for production?

[Answer] The Division of Wheat Selection has developed and submitted for state testing two new varieties of winter wheat--Mironovskaya Nizkoroslaya and Mironovskaya-26. The latter's average yields in 1975-1978 came to 68.5 quintals per hectare--6.1 quintals more than the standard (Il'ichevka). Maximum yields on the institute's fields--81.9 quintals per hectare--were achieved in 1978. The mass of 1,000 seeds was 40.9 to 45.5 grams; it had high resistance to lodging, frost-resistance on par with Mironovskaya-808, and excellent bread baking qualities. The protein content runs as high as 15.5 percent, gluten 28.3 percent, glassiness 97 percent, and weight per liter 766 grams.

Another variety, Mironovskaya-26, during the test years 1975-1978 yielded an average of 67.5 quintals per hectare or 5.9 quintals more than Il'ichevka. This variety also possesses high potential yields (up to 76 quintals per hectare), resistance to lodging and high frost-resistance (3.1 to 16 percent higher than Mironovskaya-808), and also excellent milling and baking properties; it is classified among the strong wheats.

The institute has also developed and submitted for state testing a new variety of spring wheat--Mironovskaya Rannyaya, which with a yield of 55.1 quintals per hectare surpasses the zoned variety Mironovskaya Yarovaya by 5.8 quintals. The new variety is distinguished by high resistance to lodging, a short stem (plant height 82 cm), and high responsiveness to the application of organic and mineral fertilizers. It ripens 10 to 12 days earlier than the standard and was practically unaffected by fungous diseases during the test years in the institute. Research has shown that the use of short-stem varieties (Siete Cerros-66, World Seeds-1877) for crossbreeding with winter varieties obtained specially as a result of changing spring varieties yields quite interesting and encouraging results in carrying out selective breeding programs to develop intensive varieties. On the basis of competitive varieties testing, a new variety of spring wheat has been prepared for submission for state testing: Eritrospermum-465 (Siete Cerros-66 x Lyutestsens-3067); with yields of 55.1 quintals per hectare between 1976 and 1978 it surpasses the standard by 8.2 quintals. In recent years this variety yielded 72 quintals per hectare.

Spring wheat variety Mironovskaya Yarovaya has become widespread in North Kazakhstan and Bashkiria. On the sovkhozes of Kustanayskaya Oblast last year an area of more than 20,000 hectares produced average grain yields of 19.6; on some sovkhozes in the same oblast yields ranged between 26.8 and 28.3 despite extremely unfavorable weather. On the varieties testing plots of Bashkiria, Mironovskaya Yarovaya yielded 36.6 to 51 quintals per hectare, surpassing zoned varieties by 7 to 10 quintals.

The institute has developed and zoned valuable varieties of other crops. They include Mironovskoye-51 millet, which has been zoned in 18 oblasts, and Mironovskoye-94 in 6 oblasts; also Mironovskiy-186 peas in 7 oblasts, Mironovskaya-10 Sudan grass in 15 oblasts, Mironovskiy-45 red clover in Kiev and Kirovogradskaya oblasts.

Last year we submitted for state testing the new high-yield Mironovskaya-36 variety of Sudan grass; its average green mass yield in 1976-1978 was 540 quintals per hectare, with hay yields of 97.7 quintals; these figures are respectively 88 and 9.7 quintals per hectare higher than for the standard Mironovskaya-10.

[Question] What new advances have your scientists made in further developing theoretical research and finding new paths in selection?

[Answer] Meeting socialist obligations, the institute's collective has done a number of important theoretical studies. Special attention has been focused on the further development of research in the field of applied molecular biology and genetics, the physiological-genetic principles of productivity, the genetics of immunity, also grain quality, winter-hardiness, and the refinement of techniques of selection and the widespread practical adoption of a fundamentally new technological selection system using climatic chambers and hothouses.

For obtaining valuable initial stock for winter wheat, a new technique has been worked out to change spring wheat into winter wheat; it consists of two stages. The first involves yarovization of spring wheat seeds for 90 to 120 days and subsequent spring planting. The second involves sowing the seeds obtained from the spring planting in the autumn during optimal periods for planting winter wheat (5 to 10 September). This technique makes it possible to obtain up to 80 percent winter forms and substantially increase the yield of short-stem forms (80 to 90 cm) with high-yield spikes. Promising lines of winter wheat developed in this way have yielded 72 to 78 quintals per hectare in competitive varieties testing, surpassing the standard by 7 to 13 quintals. Many years of research on the use of preliminary yarovization in artificial climate chambers to change spring forms into winter forms have resulted in a new technique for accelerating the selection process (by about 1.5 times). Constant forms are obtained as early as the third generation. Ordinary methods would require five or six generations, and sometimes as many as eight or nine.

The cytogenetics laboratory has studied the genetic principles governing the process of changing spring forms into winter forms. It has been shown that the formation of new genotypes under the influence of developmental conditions leads to alteration of the nature of the plants with respect to a set of inherited characteristics combined in groups of genes controlling the type of development (spring or winter). Under the influence of unusual and in some cases extreme (for spring forms) conditions of germination, wheat varieties enlarge the variation spectrum and increase the number of forms with altered phenotype. The time it takes for spring forms to become winter forms depends entirely on the specifics of the varietly's genotype and may vary considerably, especially in hard wheat.

It has been found that by the end of the autumn vegetative stage the M_1 spring forms accumulate considerably more RNA and DNA in the tillering nodes and RNA in the leaves than the winter wheat forms. With subsequent autumn plantings, most of the offspring develop a new, stable type of nucleic metabolism characteristic of winter forms. Intensive synthesis of RNA and DNA is an indicator of the matrix activity of the cells' nuclear matter, and for this reason we may assume the existance of winter and spring types of chromatin. Researchers have determined the influence of the light flow on the content of nucleic acids in the wheat plant. Comparative saturation by long-wave light radiation activates the synthesis of nucleic acids.

Determination of the intensity of photosynthesis in spring and winter wheat plants has shown that the main role in the intensity of this process against a background of identical temperatures is played by the quality of the light flow coming from various electrical light sources. At the same time, however, variety characteristics are also strongly manifested. Of six light sources tested, the most favorable influence on the intensity of photosynthesis was exerted by the light flow from DRL-400, DRF-1,000 and DKSTL-10,000 bulbs.

On the basis of photothermal mutagenesis in spring wheat with autumn sowing, the physiology laboratory has developed a number of winter wheat forms distinguished by relatively short stems and high frost-resistance and winter-hardiness. More than 20 such forms have been submitted for developmental selection.

In order to develop an accelerated technological system for raising selective breeding material under conditions of artificial climate, a determination has been made of the optimal combinations of lighting and temperature conditions for wheat, based on the intensity of the plants' visible photosynthesis. Optimal temperatures promoting maximum plant photosynthesis have been determined for various exposures.

Researchers have studied the influence of the quality and exposure of the light flow on the time it takes winter forms to get through yarovization. They have found that this process is relatively accelerated in the varieties under study by stepping up long-wave radiation.

Research has been done into the possibilities and ways of using a wheat tissue culture as a model specimen to investigate the mechanisms of reciprocal conversion of spring wheat forms into winter forms, also to obtain promising material for the selection of new varieties of this crop. More than 10 strains of callus tissue of varieties Khar'kovskaya-46, Il'ichevka, and Nakat have been selected for their high growth energy indicators under round-the-clock lighting. Procedures and techniques have been worked out relating to the passaging of wheat callus tissue.

Much of the research has been focused on the problem of improving the quality of the grain by selection techniques. Thus, in crossbreeding zoned Mironovka varieties with donors of high protein content (LS-66, Pardieu-4930) it has been found that the inheritance of a vital property such as the gluten content in hybrids goes through an intermediate type. This research is now being conducted jointly by collectives of the selection divisions and the grain quality laboratory.

[Question] How well has the institute met its socialist obligations in seed breeding? How are you organizing your work to accelerate seed propagation and adopt new varieties in production?

[Answer] In 1978 the institute's seed breeding division and selection divisions provided the experimental farm with all the necessary grain crop seed stock (27,500 quintals versus obligations of 20,000); this made it possible for the elite seed breeding farm to raise the necessary quantity of elite seeds and zoned and promising varieties of winter wheat, winter rye, spring barley, oats, peas, and spring wheat.

Work on propagating new promising varieties bred in the institute and setting up nurseries in the primary seed breeding links generally starts early, in the year the variety is submitted for state testing. That was the method of organizing seed breeding work for Mironovskaya-808, Il'ichevka, Mironovskaya 808 Uluchshennaya, Mironovskaya-25, and other varieties of winter wheat, Mironovskaya Yarovaya and Mironovskaya Rannyaya spring wheat, and Mironovskoye-51 and Mironovskoye-94 millet. When the time comes to zone the variety, the institute has enough seeds to supply them primarily to the scientific-research institutions of the oblasts and republics where the variety is to be zoned. This makes it possible to provide substantial quantities of seeds to the seed breeding farms of the service zone in order to accelerate the adoption of the new variety.

For varieties developed by our institute, seeds are propagated by the institute's elite seed breeding farm as well as a number of leading farms in Kiev, Cherkasskaya, Khmel'nitskaya, Vinnitskaya, Poltavskaya, Sumskaya, Zhitomirskaya, Ternopol'skaya, Rovenskaya, and Volynskaya oblasts.

Another vital factor promoting the rapid and widespread adoption of Mironovka varieties on kolkhozes and sovkhozes is the fact that by the time they are zoned each variety is accompanied by agrotechnical papers which indicate all the characteristics of cultivation to ensure the fullest manifestation of the yield potency the breeders have bred into the variety. Our field stations are doing this work for various zones of the country: the Moscow center for the Nonchernozem Zone, the Volgograd center for the Povolzh'ye, the Kustanayskiy center for North Kazakhstan, and the Altayskiy center for the Altay.

[Question] In recent years special attention has been focused on cooperation and joint efforts among scientific-research institutions to develop new varieties. With which institutes in our country and among the CEMA member countries are you collaborating, and what are the results?

[Answer] Cooperation and collaboration on the development of qualitatively new varieties of winter wheat are being conducted with scientific-research institutes of VASKhNIL [All-Union Academy of Agricultural Sciences] and the USSR Academy of Sciences. These collaborating scientific institutions have substantially expanded the scale and exchange of selective breeding material as well as information, especially during the 10th Five-Year Plan; this is unquestionably helping to raise the level and effectiveness of scientific research and making it possible to invest more energy with greater return.

In selective breeding work we ascribe great importance to bilateral collaboration with scientific-procedural institutes of the CEMA member countries. This is only logical. Mironovka wheat varieties are widespread in the socialist countries, especially in the GDR and Czechoslovakia.

In the GDR, Mironovskaya-808, Mironovskaya Yubileynaya, and Il'ichevka occupy 64 percent of all the winter wheat areas in that country. According to specialists of GDR scientific-research institutions, thanks to the cultivation of varieties developed in our institute wheat yields have been increased by 14 percent. In some areas and in some associations in that country, Soviet varieties have yielded 60 to 72 quintals per hectare.

In Czechoslovakia, Mironovka varieties are planted annually on more than 700,000 hectares; this constitutes more than 65 percent of the winter wheat planting. This high proportion of Soviet-developed varieties of wheat has made it possible for Czechoslovakia's farmers to produce an average of more than 40 quintals per hectare between 1969 and 1978. Before the introduction of Mironovka varieties, this crop yielded no more than 30 to 32 quintals per hectare.

Our institute is developing and deepening joint selective breeding work with the Bernturg-Hammersleben Institute of Grain Crops (GDR). These years of joint effort have resulted in the development of vast quantities of initial stock as well as the joint selection of Druzhba-1 and Druzhba-2 which yield 80 to 85 quintals per hectare. In 1979 plans called for submitting them for state testing.

As a result of joint selective breeding programs by the two institutes--Mironovka and the GDR Institute of Grain Crops--new varieties of winter barley have been developed which combine high yields (70 to 80 quintals per hectare) with increased frost-resistance and winter-hardiness. The best ones are included in preliminary ecological testing and are undergoing thorough testing in the collaborating institutes.

In 1976 our institute began broad cooperation with the Institute of Grain Crop Selection (Kromerik, Czechoslovakia). Implementation of the joint selective breeding program has resulted in the development of valuable winter wheat hybrid material that is now being thoroughly studied here and in Czechoslovakia.

[Question] How well has the collective of the institute's elite seed breeding farm met its socialist obligations with regard to boosting yields?

[Answer] The institute's elite seed breeding farm successfully met its obligations with respect to boosting farm crop yields. The average grain yield last year was 41.5 on 1,022 hectares while the yield of the main crop--winter wheat--was 45.6 quintals per hectare on 630 hectares; these figures are respectively 4.5 and 4.6 quintals higher than the obligations called for. Gross grain production in 1978 was 126.5 percent higher than the average annual level achieved in the Ninth Five-Year Plan.

[Question] For several years now your institute's Moscow support center has been functioning for the Nonchernozem of the RSFSR. What is it doing now and how is it helping farm production?

[Answer] Our institute's Moscow support center is organized on the territory of the Zarya Kommunizma State Pedigree Farm in Domodedovskiy Rayon, Moscow Oblast. Its main task is to determine the potential productivity of winter wheat varieties and to work out elements of high-grade agrotechnology, variety renovation timetables, and other cropping measures relating to the production of guaranteed grain yields under Nonchernozem conditions.

Many years of research have shown that Mironovka varieties of winter wheat possessing high genetic productivity potential in the central regions of the Nonchernozem Zone can, with the application of high doses of mineral fertilizers, especially nitrogen, and compliance with other cropping techniques, produce high grain yields--up to 80 or 90 quintals per hectare--of good quality. Thus, for example, the gluten content in Mironovskaya Yubileynaya and Il'ichevka runs as high as 29 to 33 percent in that zone, while the specific deformation of the dough is 300 to 350 e.a. [unidentified].

The support center has worked out recommendations on high-grade cropping techniques for Mironovka varieties of wheat (planting timetables, seed sowing norms, and other techniques), which are widely adopted and promote high grain yields. For example, all of the farms in Domodedovskiy Rayon in recent years have been getting an average of 40 quintals per hectare, while the Zarya Kommunizma Pedigree Farm has been getting 52 to 54 quintals per hectare on more than 1,100 hectares. Many such examples could be cited in Moscow Oblast as well as a number of other areas in the Nonchernozem Zone. This indicates once more that Mironovka varieties guarantee maximum grain yields under proper cultivation.

Now, havi ¸ launched socialist competition for successful implementation of the decisions of the July and November 1978 CC CPSU Plenums, the scientists, workers, and employees of the Mironovka Order of Lenin Scientific-Research Institute of Wheat Selection and Seed Breeding are responding to the high evaluation of our labor by exerting all their skills and knowledge to further enhance the effectiveness of scientific research and complete the targets of the 10th Five-Year Plan ahead of schedule.

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UDC 331.876.4:008.631.527

WORK OF THE ALL-UNION SELECTION-GENETICS INSTITUTE

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 2, 1979 pp 8-11

[Article by Doctor of Agricultural Sciences L. K. Sechnyak, Director, All-Union Selection-Genetics Institute: "The All-Union Selection-Genetics Institute in the 10th Five-Year Plan"]

[Text] Implementing the historic decisions of the 25th CPSU Congress and adjusting its scientific activities in accordance with the tasks assigned to agricultural workers by the July 1978 CC CPSU Plenum, the collective of the All-Union Order of Lenin and Order of Labor Red Banner Selection-Genetics Institute is actively involved in socialist competition and has completed the thematics plans of 1978 and the first three years of the five-year plan ahead of schedule.

In recent years, the efforts of the institute's scientists have been directed toward deeper investigation of the laws governing the development of the plant organism, the nature of the fixing and inheritance of economically useful features and traits. Much attention is being focused on finding new methods for rapidly and reliably evaluating the selection material's ability to withstand abiotic factors of the environment, diseases, and pests, also the productivity and quality of the crop. Also successfully underway is exploratory work to determine possibilities of using the latest advances in biology--cultures of plant cells and tissues, techniques of genetic engineering--in practical selective breeding.

All of this research is subordinated to a single goal--that of developing new varieties of farm crops which combine a number of valuable traits and properties: high productivity, resistance to unfavorable weather, immunity to diseases and pests, an optimal vegetative stage, increased protein content, better amino acid composition, and adaptability to intensive cultivation.

At the same time, combining such a broad complex of traits in a single variety requires not only a full output of creative energy by the selective breeder but also the active participation of geneticists, phytopathologists, biochemists, and physiologists to provide comprehensive information concernng the value of the genotype during the initial, crucial stages of selection. Our main task, therefore, is to create a new, highly-effective, economical, and harmonious technology of selective breeding to make it possible not only to substantially improve the success rate and shorten the time necessary to develop new varieties and hybrids but also to guarantee that the latter will possess the desired parameters.

Implementation of this program is largely facilitated by the inauguration of a phytotron--an artificial climate station which is the world's largest in terms of the range of adjustable conditions, the size of the air-conditioned space, and facilities for conducting experiments.

We are focusing substantial attention on the creation of conditions which will maximally reveal the potential capabilities of various genotypes with respect to individual useful traits. In other words, we are setting up optimal backgrounds for selection. Of special importance is the system of early culling (in F_2 or F_3) of genotypes having low frost-resistance which are susceptible to the most widespread diseases; this makes it possible in the initial stages to get rid of unpromising lines.

A vital stage in the work is the study of problems relating to accelerated production of several generations with minimal outlays of energy and with a high coefficient of reproduction. For example, we have found a method for shortening the yarovization of winter crops and we are determining optimal nutrition and lighting conditions etc.

The concluding experiment has been carried out to determine the soil substrates and nutrient solutions that are optimal for cultivating winter wheat plants in the phytotron's hothouses.

Comparison of the characteristics of plant nutrition with sufficient moisture availability during particular periods of vegetation has made it possible to determine moisture conditions on various backgrounds of mineral nutrition.

An express method of determining frost-resistance has been developed, making it possible to select from populations that are resistant to low minus temperatures.

We have tested conditions of yarovization, toughening, and freezing of plants under artificial climate in order to select F_2 hybrids that are resistant to frost and powdery mildew. Preliminary findings indicate the possibility of combining these traits in a single genotype.

We have studied the instensity of infestation of 11 varieties of winter wheat by yellow rust depending on the duration of the photoperiod (the greatest infestation of most of them was observed when the duration was 15 hours, while the extent was much smaller under around-the-clock lighting).

Hourly programming of the temperature, also in the course of the eight-hour lighting period and the four-hour nighttime period made it possible to obtain high yields of wheat and barley seeds in a relatively short time (70 to 75 days).

In the phytotron we have already completed more than 500 crossbreedings, raised a large quantity of hybrid plants of various generations, determined the frost-resistance of more than 5,000 variety samples, and evaluated the disease-resistance of almost 4,000 varieties and lines of wheat, barley, and sunflowers. The volume of this work is to be substantially increased.

The creation of the necessary conditions for carrying out research in the phytotron is being provided by scientific subunits of the institute headed by candidates of science S. V. Biryukov, V. N. Musich, and A. M. Chernozubov.

The end goal of a number of other theoretical applications is to modernize the selection process in a particular direction. For a number of years we have studied the possibility of the mass production of haploids of Triticale through artificial cultivation of anthers. We have confirmed the role of the genotype in the capacity for callus formation and the proline in the inducement of microspore differentiation. We have determined the significance of various environmental factors and the specifics of the nutrient media in regenerating whole plants from callus tissues obtained by embryo cultivation of the plant from interspecies crossbreedings of barley.

We are extensively studying the molecular structures of the genome of the most important farm crops and have discovered a number of physiological-genetic principles governing the productivity of winter wheat; we are determining the physiological mechanisms of the responsiveness of various genotypes of this crop to the level of nitrogen nutrition.

We have considerably developed the principles of biochemical genetics which make it possible to utilize techniques of direct identification of the genes (directly with respect to individual proteins which represent the end products of their study) that are responsible for shaping the desired trait. This in turn makes it possible to utilize these genes as markers of other genes coupled with the first. Thus, in the Division of Genetic Principles of Selection, VASKhNIL Academician A. A. Sozinov and Biochemical Genetics Laboratory Director F. A. Poperelya have shown that blocks of components of gliadin (groups of proteins of polygenic loci of chromosomes), which are the main constituents of gluten and determine the quality of the flour, can also serve as markers of the wheat plant's resistance to frost and stem rust.

Much attention is being focused on the scientific substantiation of a number of problems relating to selection and seed breeding techniques. Thus, original research has been carried out to determine the effect of cropping techniques, ecological factors, and physical and chemical influence on the biological properties, planting qualities, and crop yields of seeds. For example, we have determined that the yield properties of wheat seeds go down when nitrogen alone is applied or when it is applied to excess mixed with other macro elements. We have obtained positive results by placing seeds in a DC electrical field and treating them with laser beams: yield gains ranged from four to 9.5 percent.

Every year we are increasing the volume of phytopathological, biochemical, and technological evaluations of the selection material of wheat, barley, corn, and other crops. In multi-factor experiments we are studying problems of high-grade agrotechnology: the reaction of new varieties and hybrids to planting periods, sowing norms, doses of fertilizer, and so on. The mechanization laboratory people have designed machinery to make operations in the selection process easier.

All of this is not only laying the scientific and practical basis for selection in the future but also yielding appreciable results today.

At present, 98 oblasts, krays, and republics are cultivating 36 varieties and hybrids developed at our institute. In 1978 these crops occupied 10.3 million hectares. The economic effect due to their adoption in the first three years of the current five-year plan alone amounted to 486.8 million rubles. Another example of the acknowledgment given to the institute's varieties is Odesskaya-51 winter wheat, developed under the direction of VASKhNIL Academician D. A. Dolgushin; in terms of the planted area it occupies it holds third place in the USSR and first place in the Ukraine. The average grain yield gain in this variety is 2.7 quintals per hectare compared with other zoned varieties; during the Ninth Five-Year Plan this made it possible to harvest an additional eight million quintals of grain nationwide. Substantial areas are also occupied by the Priboy winter wheat variety developed by VASKhNIL Academician F. G. Kirichenko.

However, the institute's collective is not resting on its laurels; it is structuring its work in the field of practical selection in accordance with the new requirements conditioned by the growth of farm production, the higher level of agrotechnology, and improved moisture availability to the plants. Thus, the soft wheat varieties and hybrids laboratory (S. F. Lyfenko, director) has developed and submitted for state testing two non-lodging semi-dwarf varieties Odesskaya Polukarlikovaya and Odesskaya-75, which in most cases surpass zoned varieties for yield.

Another problem in wheat selection is that of obtaining varieties which produce high stable grain yields of increased protein content; this problem has been resolved on the basis of theoretical research carried out in the institute. Two of our varieties, Zirka and Promin', which are now undergoing state testing, possess these traits and are distinguished by high technological qualities of the grain, also by integrated resistance to fungous diseases. Yield gains for the Promin' variety averaged 10.7 quintals per hectare compared with Odesskaya-51 in the first three years under dryfarm conditions after fallow and 13.1 after peas; under irrigated conditions the average was 9.8 quintals per hectare. Similar results were also obtained in 1978 during testing of the new Chayka variety. Other new varieties of wheat submitted for state testing are the following: Yuzhnaya Zarya, Kormovaya-30, Odesskaya-76, Selena, Salyut, Progress, Kotovchanka, Kotovchanka-1, and Obriy.

A vast selective breeding program has been drawn up and definite success has been achieved in the development of varieties of winter and spring barley possessing high feed qualities. Thus, the varieties Yuzhnyy, Nutans-106, Odesskiy-36, Chernomorets, Nutans-244, and winter barley Odesskiy-46,Odesskiy-46, Orion, and Oksamit, developed in the institute's barley selection division under the direction of Hero of Socialist Labor VASKhNIL Academician P. F. Garkavoy, are being planted commercially on areas of more than four million hectares. Slavutich spring barley has been zoned for Zaporozhskaya Oblast and Zimran winter barley has been zoned for Odesskaya and Khersonskaya Oblasts as of 1978.

In 1979, plans call for submitting for state testing the best of 14 new brewing varieties distinguished by short stems and high productivity and surpassing the standard Nutans-244 by 15 to 25 percent in crop yield.

But most of the barley varieties on which the production of grain of this crop is based are classified as double-row and are insufficiently resistant to lodging or breakage of stem nodes when overripe, and are susceptible to the most widespread diseases. Because of this, the institute has begun to develop a new line of selection--the development of six-row varieties of spring barley. The first--Pallidum-90--has already been submitted for state testing on plots in a number of oblasts of the Ukraine and has yielded 47.3 to 72.9 quintals per hectare--8.9 to 17.1 more than the standards. The record crop of this variety--82.8--was produced on the Dondyushany Variety Testing Plot in Moldavia; it surpassed the Chernomorets variety by 17.4 and the Donetsk-8 by 20.8.

A number of new six-row varieties have been developed. All of them are distinguished by short, thick, and strong stems; they are not susceptible to powdery mildew, they have a large grain, and the standing crop is resistant to overripeness.

The Corn Selection Division under the supervision of P. F. Klyuchko has considerably stepped up efforts to develop high-yield corn hybrids characterized by resistance to drought and lodging, by improved grain and green mass quality, and resistance to diseases. A number of such hybrids are successfully undergoing state testing; they have been judged promising or have been zoned for Odesskaya Oblast and other areas of the country.

Of particular interest is the Odesskiy-80MV six-row silage hybrid. It is distinguished by convenient and economically advantageous seed production, because in all links the parent forms are characterized by high seed productivity. In 1979, plans call for raising 30,800 tons of first-generation seed of this hybrid in the Ukraine; it can be used to sow about 800,000 hectares in 1980. Also very promising for Odesskaya Oblast, according to two years of varieties testing, is the Odesskiy-137M hybrid, which in 1977-1978 averaged grain yields of 55.9 quintals per hectare in all testing in the oblast--7.2 quintals more than the standard Odesskiy-27MV.

In recent years we have been focusing much attention on su lower selection. The main line of effort--the development of hybrids--has proved itself very well. Now successfully undergoing state testing is the variety-line Rassvet hybrid, produced in the Oil Crop Division under the supervision of V. V. Burlov. Two-year testing in Odesskaya Oblast has shown that in terms of seed yield it surpasses the zoned Armarvirskiy-3497 by 2.1 quintals per hectare. The hybrid is also distinguished by tolerance to gray mold and is more resistant to orobanche. Now ready for submission for state testing is the variety-l ie hybrid Odesskiy-91, produced on the basis of TsMS [unidentified] with full restoration of the pollen's fertility, surpassing the standard by nine quintals of seed per hectare and 3.6 quintals of oil per hectare and possessing complex resistance to orobanche, downy mildew, and gray mold.

Success has also been achieved in alfalfa selection. On the basis of theoretical research, the Perennial Grass Selection Division (headed by N. M. Tereshchenko) has worked out a method of polycross-test and, on this basis, in a short time developed the Raduga variety which combines high stable yields of vegetative mass and seeds with excellent feed qualities. Starting in 1979, the variety is zoned in Odesskaya Oblast for irrigated and dryfarm lands and in Nikolayevskaya Oblast on dryfarm land. Compared with the standard it yields 13.2 percent more green mass, 11.8 percent more hay, and 74.7 percent more seeds; it is distinguished by early ripening and increased foliage. The use of self-fertilizing forms in synthetic selection has made it possible to develop the new Zarnitsa variety, characterized by even higher seed yields and the same dry mass yield as the Raduga variety.

Selective breeding is also underway on sainfoin, peas, sorghum, and Sudan grass.

In addition to theoretical research and practical selective breeding, the institute is also undertaking a set of measures to organize the production testing and adoption of its varieties and hybrids in production and to supply the kolkhozes and sovkhozes with high-quality seed. Our network of support operations have been substantially expanded, where we test and propagate new promising varieties and hybrids developed by the institute. At present, this work is underway on 41 farms in Odesskaya, Nikolayevskaya, Khersonskaya, Krymskaya, Dnepropetrovskaya, Poltavskaya, Kirovogradskaya, Cherkasskaya, Donetskaya, Rostovskaya, Zaporozhskaya, Chernigovskaya, Belgorodskaya, Lipetskaya, and Penzenskaya oblasts, also Stavropol'skiy Kray and the Moldavian SSR.

Every year, our elite seed breeding farms are overfulfilling plans of high-grade seed production and sales. In 1978, for example, they raised and sold 51,600 quintals of winter crop seeds (155.4 percent of the planned), including 41,300 quintals of winter wheat, 8,800 quintals of winter barley, and 1,500 quintals of winter rye. Also ready for sale are 12,100 quintals of seeds of spring grains, grain legumes, oil crops, and grasses (substantially more than the plan called for).

Since it is the Coordinating Center for the CEMA member countries with regard to the problem "Formulation of Theoretical Principles of Selection and Seed Breeding and New Methods of Developing High-Yield Varieties and Hybrids of Farm Crops," involving 78 institutes and other scientific-research institutions, the All-Union Selection-Genetics Institute is successfully working with scientists of the socialist countries in the field of the genetic principles of intraspecies, interspecies, and intergenus hybridization in order to produce initial stock for the development of new, perfected varieties. Researchers have synthesized new forms of hybrids and amphidiploids of high productivity, excellent grain quality, and a number of other economically valuable traits and properties. Work is nearing completion on the development of combined varieties of winter rye, barley, and other crops.

As the head institution of the Southwestern Selection Center, the institute's activities include cooperative research on the basis of the exchange of selection material, the formulation of integrated themes, and the constant exchange of work experience; this makes it possible to speed up the process of developing new varieties. Every year the selection center completes plans with respect to submitting varieties for state testing by 200 percent.

As a major center of agricultural science, the institute also provides considerable methodological aid for production. In 1978 alone, we took part in holding 38 seminars and conferences dealing with current problems of boosting crop yields; we organized 10 television features, published more than 20 articles in newspapers, and issued recommendations and information sheets. Special courses organized in the institute have upgraded the qualifications of 30 scientific staff members from various scientific-research institutions and 297 field agronomists and seed breeders and trained 167 acceptance officers for the farms of Odesskaya Oblast. The institute's divisions and laboratories are training talented young people from various scientific-research institutions.

We are constantly focusing much attention on strengthening and modernizing the material-technical base for conducting scientific research. We have built a unique facility--a phytotron with a laboratory building; we have rebuilt the hothouse complex; the divisions and laboratories are outfitted with modern equipment; extensive construction is underway on a selection base on the Dachnaya Elite Seed Farm; in addition, housing conditions for the staff members have been substantially improved in recent years.

We are aware, nevertheless, that our successes so far are just the beginning of major projects for which all the necessary conditions have been created thanks to the constant concern of the Communist Party and the Soviet government.

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AGROTECHNOLOGY

F. G. KIRICHENKO HONORED

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 2, 1979 pp 12-13

[Article: "Fedor Grigor'yevich Kirichenko (on the 75th Anniversary of his Birth)"]

[Text] March of this year marked the 75th birthday and 50 years of scientific, production, and social endeavors of VASKhNIL Academician and Honorary Academician of the Czechoslovak Agricultural Academy, Doctor of Agricultural Sciences, Hero of Socialist Labor, State and Lenin Prize Winner, and director of the Wheat Selection Division of the All-Union Selection-Genetics Institute, Fedor Grigor'yevich Kirichenko.

Fedor Grigor'yevich was born in a peasant's family in the village of Vladislavka, Mironovskiy Rayon, Kiev Oblast. He went to work while still an adolescent and constantly strove to improve himself. He graduated from the agricultural school in 1922 and then enrolled in the Maslovo Agricultural Vocational School. His interest in agriculture led him to the Maslovo Selection and Seed Breeding Institute--the Soviet Union's first selection-seed breeding training institution. His fellow-students included persons who were destined to head our selective breeding and agricultural sciences. They included V. N. Remeslo, P. F. Garkavyy, V. A. Gordiyenko, A. V. Pukhal'skiy, and many more. After Maslovka he headed the Maslovo Agricultural Vocational School, enrolled in graduate studies at the Odessa Selection-Genetics Institute, defended his candidates dissertation, and headed the institute's Division of Winter and Spring Wheat Selection.

When war broke out, the selective breeder was assigned to evacuate and safeguard the institute's most valuable selection material. This is what he did. Everyone is aware of the difficulty--sometimes no less difficult than on the front lines--of the work of agricultural specialists during the war. After Odessa was liberated from the German fascist invader in 1944, F. G. Kirichenko returned to the institute and since that time has headed the institute's Division of Wheat Selection and Seed Breeding, and at one time headed the whole institute.

After the war, F. G. Kirichenko had to begin his scientific-research work essentially all over again. Laboring intensively and constantly, during the first post-war years the selective breeder developed highly winter-hardy and high-quality varieties of winter wheat of the steppe ecotype: Odesskaya-3, Odesskaya-16, and others essential for farm production. They were widely acknowledged and were zoned in many oblasts, krays, and republics.

Between 1946 and 1969 they were cultivated on more than 53 million hectares. The adoption of Odesskaya-3 and Odesskaya-16 resulted in the additional production of about 18 million tons of wheat grain of high quality. This made a substantial contribution toward restoring and stabilizing the country's grain balance, which was disrupted by the war.

Considering the requirements of farm production, with its ever-increasing intensification, the selective breeder has directed the division's efforts toward the development of intensive varieties of winter and spring wheat combining not only high winter-hardiness, drought-resistance, and excellent milling and baking qualities but also high yields, resistance to lodging, diseases, and pests.

Basing his work on the crossbreeding of appropriately selected, geographically remote varieties of the steppe ecological group that are well-adapted to conditions of cultivation with intensive varieties of the wooded-steppe ecological type and with the best varieties from other areas, in recent years F. G. Kirichenko has developed a number of new high-yield and winter-hardy varieties of winter wheat distinguished by increased productivity and winter-hardiness; one of them is Priboy.

Under the direction of F. G. Kirichenko, researchers for the first time in the history of Soviet selective breeding developed a completely new grain crop--hard winter wheat. Varieties of this wheat--Novomichurinka and Odesskaya Yubileynaya--are distinguished by high winter-hardiness and excellent pasta qualities, producing high stable yields of 35 to 45 quintals per hectare.

Farm production workers have had high praise for the new high-yield hard spring wheat variety Nakat, developed jointly with the division's staff members. Special mention should be made of the fact that in selective breeding Academician F. G. Kirichenko makes extensive use of various techniques and methods--intraspecies and interspecies hybridization, crossbreeding of ecologically close and remote forms, experimental mutagenesis, conversion of spring forms into winter forms, and many others. He has developed an original technique of selecting plants in terms of the capacity of root system development. He has proposed the selective evaluation and culling of wheat hybrids on the basis of first-generation indicators.

F. G. Kirichenko has focused much attention on the indoctrination and training of scientific cadres and the publicizing of advances in vital problems of selective breeding, seed breeding, genetics, and advanced experience.

F. G. Kirichenko combines his scientific-organizational and production activities with high state and social endeavors. A deputy chairman of the Section of Grain Crops of VASKhNIL's Department of Plant Husbandry and Selective Breeding, he has done a great deal to organize and improve the level and effectiveness of selection and seed breeding work in the country for wheat and other crops.

By his profound understanding of the urgent problems facing farm production and problems of selection and seed breeding, by the high standards which he sets for himself and others, and by his responsiveness and good will, F. G. Kirichenko has earned the respect of farm workers, selective breeders, testers, and party and soviet workers.

Farm specialists, production workers, and the editors and the editorial board of this journal wish our esteemed colleague good health, long years, and new creative successes for the good of our socialist Homeland.

6854
CSO: 1870

AGROTECHNOLOGY

P. L. GONCHAROV BIRTHDAY NOTED

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 2, 1979 p 13

[Article: "Petr Lazarevich Goncharov (on the 50th Anniversary of his Birth)"]

[Text] Petr Lazarevich Goncharov has been working 25 years on the development of new varieties of feed crops. While still a graduate student at Siberian Scientific-Research Institute of Agriculture he isolated an item of Italian millet which became the ancestor of the Barkhatnyy, which is now zoned in Omskaya, Kurganskaya, and Ural'skaya oblasts. After completing his graduate work, he worked almost 20 years at the Tulun Selection Station (serving as director in his final years).

He has personally participated in developing 13 new high-yield varieties of feed crops, 10 of them zoned in 7 oblasts. The following deserve special mention: Tulunskaya and Skorospelaya-16 fast-ripening maple pea, Tayezhnaya and Tulunskaya Gibridnaya alfalfa, Tulunskiy awnless brome grass, Severyanka green bristle grass, Sayanskiy white sweet clover, Baykal'skaya and Nadezhda spring vetch, and Priangarskaya meadow fescue.

During his years at the Tulun Station and now at the Siberian Scientific-Research Institute of Plant Husbandry and Selective Breeding, these institutions have carried out vital theoretical research into the selective breeding of feed crops, refined a number of methodological problems, and developed techniques for isolating new varieties. At present, Academician Goncharov is developing methods of creating synthetic varieties of perennial grasses and heterotic hybrids. In addition, the selective breeding program "Alfalfa" is being implemented successfully under his direction.

It should be emphasized that for its accomplishments in All-Union Socialist Competition last year the Siberian Scientific-Research Institute of Plant Husbandry and Selective Breeding was awarded the Challenge Red Banner of the CC CPSU, the USSR Council of Ministers, the AUCCTU, and the CC Komsomol. Unquestionably, this is largely to the credit of its director--Academician Petr Lazarevich Goncharov.

For services in the selective breeding of farm crops and his considerable organizational endeavors, P. L. Goncharov has twice been awarded the Order of Labor Red Banner and the Order of the October Revolution. P. L. Goncharov is observing his 50th birthday with a flowering of creative energy.

We wish our esteemed colleague good health and success in scientific and social endeavors.

6854
CSO: 1870

AGROTECHNOLOGY

UDC 633.11"324":631.524.86

SELECTION OF WINTER WHEAT FOR RESISTANCE TO BROWN RUST

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 2, 1979 pp 22-23

[Article by Candidate of Agricultural Sciences Ye. T. Kashirskaya, Tambovskaya Agricultural Experimental Station]

[Text] One of the serious factors leading to reduced yields in winter wheat varieties in the central Nonchernozem Zone is infestation by brown rust. Researchers N. E. Borlang (1958), E. E. Geshele (1964), N. I. Semenko (1965), and others have shown that parasite fungi invading wheat are constantly generating new virulent races by mutation and by sexual and vegetative hybridization. It is for this reason that it is vital to differentiate them and find new sources of resistance.

Race 77 is widespread in Tambovskaya Oblast, affecting most of the varieties. Also widespread are races 20, 57, and 143. Races 129 and 192 have also been detected in small quantities on new varieties. The widely zoned variety Mironovskaya-808 is affected by races 20, 77, 143, and 57. Some fungus races (129 and 119) were first detected on the Oktyabr'skaya variety. They are not yet widespread in Tambovskaya Oblast, but they may pose a danger for new varieties. We are taking account of this in the selective breeding of winter wheat.

As donors of high resistance we have selected varieties 10N120-AD, PPG-36, Lyutestsens-16 (K-1296), Lyutestsens-58 (K-1316).

Between 1969 and 1975, while crossbreeding immune varieties with relatively resistant varieties (Kavkaz, Dneprovskaya-303) and susceptible varieties (Mironovskaya-808, Avrora and others), the percentage of resistant plants tended to predominate in the first generation in direct crossings; in reverse crossing there was a tendency for the plants' infestation by local fungi races to increase sharply compared with the resistant parent forms (Table 1).

Table 1. Degree of Infestation of Plants of Hybrids F_2 from Direct and Reverse Crossings by Population of Local Races (1973-1974)

(1) Комбинация скрещивания	(2) Гибриды		(3) Материнская форма		(4) Отцовская форма	
	(5) интенсивность поражения (%)	(6) тип поражения (балл)	(5) интенсивность поражения (%)	(6) тип поражения (балл)	(5) интенсивность поражения (%)	(6) тип поражения (балл)
(7) К-1296 Лютесценс 16×Кавказ	5	0—1	0	0—1	65	3
(8) Кавказ×К-1296 Лютесценс 16	45	3	65	3	0	0
(9) К-1316 Лютесценс 58×Мироновская 808	10	2	5	0—1	70	4
(10) Мироновская 808×К-1316 Лютесценс 58	45	3	70	4	5	0—1
(11) ППГ 36×Кавказ	10	1—2	0	0	65	4
(12) Кавказ×ППГ 36	30	3	65	4	0	0—1
(13) 10Н120 АД×Кавказ	5	0—1	0	0	65	4
(14) Кавказ×10Н120 АН	30	3	65	4	0	0
(15) АН 119×Аврора	5	0—1	0	0	75	4
(16) Аврора×АН 119	35	3	75	4	0	0—1
(17) Мироновская 808×Бархатная	65	4	65	4	40	4
(18) Бархатная×Мироновская 808	60	4	40	3	65	4
(19) Октябрьская×Ильичевка	5	3	20	3	20	3
(20) Ильичевка×Октябрьская	10	3	20	3	20	3

Key:

(1) Crossing combination
(2) Hybrids
(3) Maternal form
(4) Paternal form
(5) Intensity of infestation (percent)
(6) Type of infestation (points)
(7) K-1296 Lyutestsens-16 x Kavkaz
(8) Kavkaz x K-1296 Lyutestsens-16
(9) K-1316 Lyutestsens-58 x Mironovskaya-808
(10) Mironovskaya-808 x K-1316 Lyutestsens-58
(11) PPG-36 x Kavkaz
(12) Kavkaz x PPG-36
(13) 10N120-AD x Kavkaz
(14) Kavkaz x 10N120-AN
(15) AN-119 x Avrora
(16) Avrora x AN-119
(17) Mironovskaya-808 x Barkhatnaya
(18) Barkhatnaya x Mironovskaya-808
(19) Oktyabr'skaya x Il'ichevka
(20) Il'ichevka x Oktyabr'skaya

Table 1 shows that not a single crossing combination resulted in hybrids fully resistant to the population of local races of fungi. It is true that a tendency toward predominately mild susceptibility was seen in hybrids under direct crossing (K-1296 Lyutestsens-16 x Kavkaz, K-1316 Lyutestsens-58 x Mironovskaya-808, 10N120-AD x Kavkaz and so on.

In the crossing of two susceptible varieties (for example, Mironovskaya-808 x Barkhatnaya), susceptibility dominated both in direct and in reverse crossings. Of these hybrid populations, not a single resistant plant was isolated in F_2.

In the crossing of medium-resistant varieties (Oktyabr'skaya x Il'ichevka), resistance dominated in F_1 regardless of whether they were used as maternal or paternal forms. In F_2 we managed to isolate up to 40 percent plants medium-resistant to this disease, 10 to 20 percent with the intermediate type of inheritance, and 40 to 50 percent susceptible.

The research findings were confirmed by data of the immunological characteristics of F_2 hybrids being studied in NISKhI [expansion unknown].

We have found that on some hybrids under natural conditions the disease does not develop uniformly: some of the hybrids are infested by 15 to 20 percent, others show only isolated pustules.

Lines which were affected by rust 12 to 15 days later than the rest of the selection material were of the most interest. They proved to be more productive, with a greater mass per 1,000 grains (Table 2).

Table 2. Productivity and Resistance of Lines to Population of Local Races (1973-1974)

№ линии (1)	Комбинации скрещиваний (2)	Степень поражения ржавчиной (%) (3)		Урожай зерна (% к контролю) (6)	Масса 1000 зерен (г) (7)
		в период колошения (4)	в фазе молочной спелости (5)		
37 975	Мироновская 808 (контроль) (8)	20	40,9	100	37,2
37 975	(Мироновская Юбилейная×Восход)×ППГ 186 (9)	10	49,0	111,6	39,9
37 981	Крупноколосая×Ильичевка (10)	(18) Отдельные пустулы	19,8	140,4	43,5
37 987	Крупноколосая×Ильичевка (11)	15	31,4	114,8	38,2
37 330	Ильичевка×Октябрьская (12)	(18) Отдельные пустулы	22,6	121,5	41,0
37 999	Ильичевка×Октябрьская (13)	13	40,8	110,6	37,5
37 965	Кавказ×Лютесценс 259 (14)	(18) Отдельные пустулы	13,3	126,6	42,7
37 961	Кавказ×Лютесценс 259 (15)	12	54,5	110,0	38,4
37 986	Ильичевка×Крупноколосая (16)	(18) Отдельные пустулы	21,8	131,0	44,9
38 001	К-44777 МО 944 (Норвегия)×Октябрьская (17)	16	40,9	117,5	38,3

Key:
(1) Line number
(2) Crossing combinations
(3) Degree of rust infestation (percent)
(4) Heading stage
(5) Milky ripeness phase
(6) Grain yield (percent of control)
(7) Mass per 1,000 grains (grams)
(8) Mironovskaya-808 (control)
(9) (Mironovskaya Yubileynaya x Voskhod) x PPG-186
(10) Krupnokolosaya x Il'ichevka
(11) Krupnokolosaya x Il'ichevka
(12) Il'ichevka x Oktyabr'skaya
(13) Il'ichevka x Oktyabr'skaya
(14) Kavkaz x Lyutestsens-259
(15) Kavkaz x Lyutestsens-259
(16) Il'ichevka x Krupnokolosaya
(17) K-4477-MO-944 (Norway) x Oktyabr'skaya
(18) Isolated pustules

Table 2 shows that during the heading stage line 37981 had only isolated pustules of brown rust on the leaves, while 37987, of the same origin, was 15 percent affected during that period (versus 20 percent in the control). As a result, the former--27981--surpassed the latter (37987) and the control in terms of grain yield.

It was also found that lines with mild but early infestation become nonresistant in subsequent years in most cases in the final stages of the epiphytotic.

Thus, the data we obtained show that selections for resistance to rust must be carried out in hybrid populations in which resistance predominates and which are affected considerably later than the rest of the selection material. For this reason, it is advisable to conduct double verification of the selection material for resistance to disease: during the heading period and at the end of the milky ripeness phase, taking account of the association of immunity with other economic and biological traits.

6854
CSO: 1870

AGROTECHNOLOGY

UDC 633.11"324":631.524.86

RESISTANCE OF WINTER WHEAT VARIETIES TO BASAL BACTERIOSIS

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 2, 1979 pp 24-25

[Article by Candidates of Biological Sciences I. B. Koroleva and V. G. Novokhatka]

[Text] Bacterial diseases affecting winter wheat cause considerable damage and in some years lead to substantial losses of the grain crop. Research we carried out between 1971 and 1975 shows that the basal bacteriosis that is most widespread in the Ukraine is the one caused by Pseudonomasatrofacien (McCulloch) Stapp. The disease affects winter wheat at all phases of growth and development, causing the formation of brown, dark brown, and black spots on the spikelet glumes, the awns, the spike stems, the leaves, and the stems. With severe infestation, almost all of the glumes turn dark and the spike turns a brown to dark brown color and forms small, undersized seeds.

In 1972-1975, the Mironovka Scientific-Research Institute of Wheat Selection and Seed Breeding artificially inoculated several varieties and items of competitive varieties testing developed by Academician V. N. Remeslo, also collection samples, with strains of P. Atrofacians cultivated in the Division of Phytopathogenic Bacteria of the Ukrainian SSR Academy of Sciences Institute of Microbiology and Virusology in order to evaluate their resistance to agents causing basal bacteriosis.

The soil of the test plot was thick, low-humus, coarse-silty light loamy mildy-alkali chernozem. The predecessor was bare fallow. Manure was applied at the rate of 20 tons per hectare, and full mineral fertilizer $N_{60}P_{30}K_{30}$. The record plot area was 1.5 square meters. The plants--10 of each variety--were inoculated in the main stem with a suspension of the agent by means of a syringe of the Rekord type 7 to 10 days before the heading stage. The titration of the latter was one billion cells per ml. The control consisted of plants whose stems were similarly inoculated with the same amount of sterile water (0.5 ml each).

Evaluation of the resistance of the varieties was made in accordance with a complex of traits, taking account of the degree of their infestation, using a four-point scale. We recorded the deformation of the spike, the stunting of the plants' growth, and the size of the spots on the stem, the leaves, the spike glumes, and the awns. We determined the number of spike-forming plants, the length of the stem, the number of spikelets and grains in the spike, their mass, and the mass per 1,000 grains, and noted changes in the spike, and on this basis judged the variety's or item's resistance to the bacteriosis agent.

The degree of bacteriosis development varied depending on the year's meteorological conditions. Thus, the plants were severely affected in 1973, which was most favorable for basal bacteriosis, because in May the relative humidity was six percent above normal and the air temperature was two degrees C below the many-year average; the plants were mildly affected in the dry year of 1975, which was least favorable for the development of the infection process in inoculated plants. During the period of investigation we tested 168 varieties and items, including 129 developed at the Mironovka Institute, seven developed at the Krasnodar Scientific Institute of Agriculture, four developed at the All-Union Selection-Genetics Institute, and 20 developed abroad.

It turned out that there are no forms of soft wheat that are absolutely resistant to basal bacteriosis, but there are differences in the degree of infestation. All of the tested varieties and items can be divided into four groups.

Group One: Mildly affected. Spots on sheaths and leaf blades are never large, all of the plants form spikes after inoculation, changes in the spikes are insignificant, and grain-crop losses from the spike do not generally exceed five percent compared with the control. The most typical of this group are: Lyutestsens-3329, a promising selection item from competitive varieties testing of the Mironovka Scientific-Research Institute of Wheat Selection and Seed Breeding and the Caprock and Sturdy varieties developed in the United States.

Group Two: Moderately affected. A somewhat larger group than Group One. Crop losses run as high as 10 percent. The group includes Mironovskaya-10, Mironovskaya-25, Karlik-1523/1, and PPG-1338, all developed in the Soviet Union, Grana (Poland), Felix (FRG), Habicht (FRG), and others.

Group Three: Medium affected. The largest group, which includes Mironovskaya Yubileynaya, Mironovskaya-808 Uluchshennaya, Kavkaz, Krasnodarskaya-46, Yuzhnoukrainka, Priboy, Volna, Odesskaya-51, Polesskaya-70, Polesskaya-71, and Ivanovskaya-6, also Gaines (United States), Warrior (United States), Progress (FRG), Hadmerslebener-17855/68, Hadmerslebener-9554/67, Hadmerslebener-9547/67 (GDR), and Flevina (Holland).

Group Four: Severely affected. The spots at the point of injection on the sheath run to several centimeters in diameter. The plants may not form spikes. The spike is spotted and severely deformed, and many blossoms are sterile. Crop losses exceed 20 percent. These include many zoned varieties, including Ukrainka-246, Mironovskaya-808, Il'ichevka, Bezostaya-1, Bezostaya-2, Avrora, Zagadka-44, Nadezhnaya-45, Belotserkovskaya-22, Belotserkovskaya-33, and foreign varieties Pantus (FRG), Norin-62 (Japan), and others.

It has been found that some varieties show immunological nonuniformity to both bacterial diseases and to fungi. Thus, a line from Mironovskaya-10, which is distinguished by tall stems, proved to be considerably susceptible to black bacteriosis (Xanthomonas translucens) and more resistant to basal bacteriosis, while a line with short stems surpassed the variety (complex population) in terms of resistance to both disease-causing agents; this indicates the possibility of selecting for this trait in hybrid populations.

6854
CSO: 1870

AGROTECHNOLOGY

UDC 633.34:631.524.86

RESULTS OF EVALUATING THE RESISTANCE OF SOY SAMPLES TO BACTERIAL DISEASES

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 2, 1979 pp 25-26

[Article by Doctor of Agricultural Sciences Yu. P. Myakushko and Candidate of Agricultural Sciences D. V. Podkina (VNIIMK)]

[Text] Soy is coming to be of increasing importance to the economy year after year. But crop yields are still too low. One reason is its susceptibility to many diseases. In Krasnodarskiy Kray, considerable damage is caused by two forms of bacteriosis: Cotyledonous, affecting the shoots, and leaf, affecting the mature plant.

In searching for sources of resistance by this crop to bacteriosis, researchers in VNIIMK [All-Union Scientific-Research Institute of Oil Crops] evaluated 1,100 samples from VIR's [All-Union Scientific-Research of Plant Husbandry] world collection.

The evaluation of resistance to the Cotyledonous form of bacteriosis was carried out in the field on a naturally-infected background 12-15 days after sowing and in the hothouse on an artificial background 7-10 days after sowing.

Under field conditions, researchers determined the degree of infestation and the number of diseased plants on plots of five square meters with crop densities of 250,000 plants per hectare.

In the hothouse, the seeds were sown in wooden boxes measuring 2.5 by 0.5 meters filled with a nutrient mix consisting of 3 parts earth and 1 part sand. The artificially-infected background was created by introducing remnants of infected plants and seeds rotted by the bacteriosis. Two varieties were used as the control: The relatively resistant VNIIMK-6, and the Komsomolka, which is severely affected by Cotyledonous bacteriosis.

Resistance to the Cotyledonous bacteriosis was determined by the number of diseased plants and the extent of their infestation on a five-point scale:

0--absence of the disease; 1--small, isolated spots; 2--spots do not occupy more than one-third of the cotyledon; 3--not more than one-half of the cotyledon; 4--more than half of the cotyledon; 5--distorted, rotted growth.

On the artificial background, most of the samples were severely affected by Cotyledonous bacteriosis. There were no unaffected forms. Ten varieties most resistant to this disease were singled out, most of them having dark-colored pods (see table). Despite a high percentage of diseased plants, samples VIR-4705,and VIR-4793 were only slightly affected; this is of considerable interest for selection.

Samples of Soy Most Resistant to Cotyledonous Bacteriosis

(1) Номера делянок	(2) Сорта и их происхождение	(3) Окраска семенной кожуры	(4) Поражение растение			
			(5) в теплице		(6) в поле	
			(7) количество (%)	(8) степень (балл)	(7) количество (%)	(8) степень (балл)
3472	ВИР 4538 (КНР) (9)	черная (19)	60,0	1—2	40,0	1—2
3497	ВИР 4705 (КНР) (10)	черная (19)	100,0	1	9,0	1—2
3507	ВИР 4793 (СССР—Молдавия) (11)	желтая (20)	70,0	1	5,0	1
3528	ВИР 5008 (СССР—Дальний Восток) (12)	желтая (20)	20,0	1—2	3,5	1
3531	ВИР 5023 (КНР) (13)	буро-коричневая (21)	10,0	1—2	3,0	1
3545	ВИР 5088 (Голландия) (14)	черная (19)	40,0	1—2	15,0	1—2
3547	ВИР 5098 (Болгария) (15)	черная (19)	40,0	1—2	—	—
3548	Гер-Мюллер 789 (Болгария) (16)	черная (19)	100,0	1—2	42,0	1—2
3552	ВИР 5142 (СССР—Молдавия) (17)	красно-коричневая (22)	5,0	1	3,5	1
3561	Баньемэндоу (КНР) (18)	желтая (20)	20,0	1	20,0	1—2

Key:

1. Plot number
2. Varieties and their origin
3. Coloration of seed pod
4. Infestation
5. In hothouse
6. In field
7. Quantity (percent)
8. Degree (points)
9. VIR-4538 (China)
10. VIR-4705 (China)
11. VIR-4793 (USSR, Moldavia)
12. VIR-5008 (USSR, Far East)
13. VIR-5023 (China)
14. VIR-5088 (Holland)
15. VIR-5098 (Bulgaria)
16. Ger-Myuller-789 (Bulgaria)
17. VIR-5142 (USSR, Moldavia)
18. Ban'yemendou (China)
19. Black
20. Yellow
21. Brown to dark brown
22. Red to dark brown

No correlation between resistance and the origin of the samples was determined. Samples resistant under hothouse conditions were also resistant in the field. Kubanskaya-4958, Kormovaya-1, VNIIMK-8, Rannyaya-5, Rannyaya-10, Primorskaya-495, Kirovogradskaya-3, VIR-4489, VIR-2412, VIR-2419, VIR-4217, and others were resistant in the field but were severely affected in the hothouse. Komsomolka, Krasnodarskaya-67, Vysokoroslaya-3, Adreula-6, Arktik, Mandarin, and Amsoy--a total of 410 varieties--were very susceptible to Cotyledonous bacteriosis.

Non-susceptibility to bacterial wilt in the field was recorded during the period of massive development of the disease (the blossoming and bean formation phases) on the basis of the number of affected plants on the plot, using K. V. Nikitin's scale (1971): 0--immunity, no wilted plants; 1--high resistance, 1 to 10 percent wilted plants; 2--resistance, 11 to 25 percent; 3--medium infestation, 26-50 percent; 4--susceptibility, over 50 percent.

In Krasnodarskiy Kray, the abundance of precipitation and the high air temperature in the summer of 1976 promoted the massive development of bacterial wilting. This made it possible to evaluate resistance to the disease on a naturally-infected background. There were no samples that were immune to the disease. But the number of affected plants varied. Some 112 samples were highly-resistant: Khabarovskaya-4, Amurskaya-41, VIR-3934, Khersonskaya-1, Odesskaya-80, Terezinskaya-2, and others; resistant varieties included several developed by VNIIMK (Komsomolka, Rannyaya-5, Rannyaya-10, VNIIMK-6); susceptible varieties included Mandarin, Chippewa, Kapital, Bison, Pravda, Aurica, VIR-1281, VIR-2116, VIR-4514, VIR-3841, VIR-5023, VIR-1070, and others, a total of 256.

Non-susceptible to Cotyledonous bacteriosis and bacterial wilting were VIR-5142 and VIR-4793, which are of value in selection. VIR-5023, highly-resistant to Cotyledonous bacteriosis proved to be severely susceptible to bacterial wilt during the bean formation stage. Komsomolka, which is susceptible to Cotyledonous bacteriosis, was highly-resistant to bacterial wilt.

As a result of our research, therefore, we singled out the following varieties in the world collection that are resistant to bacterial diseases: VIR-5142, VIR-4793, Komsomolka, Rannyaya-5, Khersonskaya-5, VIR-3934, Adams, Gloria, Altona, and others. They can serve as initial material for selective breeding for resistance.

6854
CSO: 1870

AGROTECHNOLOGY

UDC 633.11"324":631.527

PROMISING FORMS OF WINTER WHEAT

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 2, 1979 p 30

[Article by Candidates of Agricultural Sciences D. I. Patseka and V. F. Kosterin (Kursk Support Station of the All-Union Scientific-Research Institute of Plant Husbandry imeni N. I. Vavilov]

[Text] Since 1972 we at the Kursk Support Station of the All-Union Scientific-Research Institute of Plant Husbandry imeni N. I. Vavilov have been studying (using VIR methods) the economic and biological properties of 600 variety-samples of winter wheat from the main geographic areas where they are cultivated.

By now, research carried out under contrastive weather conditions has resulted in the isolation of forms that are of interest to selective breeding. Highest yields characterized the varieties Engelens Attila and Rimpauw (GDR), Teyskaya (Hungary), Tadorna (Holland), Riley and Racine (United States),Jokijonen (Finland), and SV.59559 and SV.28/1056 (Sweden).

The Jokijonen, SV.59559, Teyskaya and Engelens Attila surpassed the standard Mironovskaya-808 in terms of the mass of grain per plant, the number of grains per spike, and productive bushiness, and the latter in addition was superior in terms of the size of the grain and resistance to lodging.

High absolute and relative winter-hardiness during the test years characterized B.503, 04819, Elo, and Linna (Finland), Canadian and CAN-2541 (Canada), Dankowska-40 (Polland), and Blackhawk, Knox-62, Cheyenne (United States).

For the development of intensive varieties we can recommend these samples: Hesbignon (Belgium), Sambo and Hector (Holland), Heine VII, Felix, Schweigers Jubilar (GDR), Villaglari (Italy), Fundulea (Romania), Nugaines (United States), B-21-3-6 (France), SV. Sonnen II (Sweden), and the Soviet variety Rannyaya-12. During the study, including during the vegetative stage of 1973, which was characterized by excessive precipitation and stormy winds, they manifested considerable resistance to lodging and had large, productive spikes.

United States varieties Purdue, Riley, Omaha, and Triumph, and Soviet varieties Priboy and Yubileynaya-50 proved to ripen 5 to 8 days faster than the standard under the zone's conditions.

A group of promising varieties was singled out in terms of the basic elements of the crop structure. Thus, a high mass of grain per plant characterized the American samples Blackhawk, Wakeland, Warrior, Laporte, Newturk, and Rodco; large grains characterized the Hungarian Teyskaya, the Canadian Winalta, the United States Rodco, and the Soviet Amphidiploid AD-767-16. In terms of the number of grains per spike, the following considerably surpassed the standard: AD-767-16 (USSR), Muck (GDR), Dankowska-40 (Poland), Thul III, Olimpia, A. 5790, B. 503 (Finland), and Odin (Sweden).

For selection for resistance to brown leaf rust (Puccinia triticina) the following can be used: Soviet amphidiploids No 3, No 4, No 138/2, 2083-2, NAD-2346, 71-45, PRAG-37/2, PRAO-5/7; of the foreign varieties--Consul (GDR), Blackhawk, Cheyenne, Racine, and Vermillion (United States), Charkow x Smontanum (Canada), and Ag-119 (Sweden).

Constituting a valuable gene fund for selection for immunity are those varieties which combine resistance to rust and powdery mildew. They include the Soviet forms hybrid 4866 (K-46088), and amphidiploids Derzhavin (K-45876) and 767-16 (K-45778), also the United States variety Jancer.

The varieties we have isolated constitute valuable initial material for the selective breeding of winter wheat in the Central Chernozem Zone and adjacent areas.

6854
CSO: 1870

AGROTECHNOLOGY

UDC 633.16"321":631.527

VALUABLE VARIETIES OF SPRING BARLEY

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 2, 1979 pp 31-32

[Article by Candidate of Agricultural Sciences G. A. Il'ichev]

[Text] From 1971 to 1975, researchers at the Ustimovskaya Experimental Station of VIR [All-Union Scientific-Research Institute of Plant Husbandry] studied about 700 variety-samples of various origin in the collection nurseries. The experiments were set up on plots of one to three square meters in single and triple repetitions. The best samples isolated in the study were sown in the control nursery (five square meters) in preliminary and competitive variety tests (50 square meters).

The main phenological observations of the crops and the recording of diseases (chiefly powdery mildew, leaf rust, loose smut, and helminthosporiosis), the degree of lodging, the results of biometrical analysis of the spike, and the crop structure were carried out using VIR procedures.

Of greatest interest for selection as initial material for fast maturation are the Soviet varieties Krasnodarskiy-35, Skorospelka-1, and Yuzhnyy, and foreign varieties Tokax-157/37 (Turkey), Ratna Jyoti (India), Damnyr (Austria), hybrid forms from Czechoslovakia (K-23241, K-23242), Ecuador (K-21603, K-21608, K-21609, K-21615, K-21623, K-21626, K-21627, and K-21640), local varieties from Afghanistan (K-20671, K-20672, K-20673, K-20686, K-20689, K-20693, K-20694, K-20698, K-20707, K-20709, K-20710, K-20746), Algeria (K-19941), Morocco (K-20820, K-20788, K-20789), and Tunisia (K-20834, K-20835, and K-20837). They formed spikes 5 to 10 days earlier than the standard Nosovskiy-6, and their vegetation period was 3 to 13 days shorter.

Under our conditions, fast-ripening varieties of foreign selection are characterized by low yields (37.2 to 75.2 percent of the standard). A positive aspect is the fact that many of them are distinguished by short stems and large grains, especially samples from Afghanistan (K-20678, K-20716) and Morocco (K-20765, K-20780, K-20783, K-20790, K-20791, K-20793, K-20795, K-20797, K-20804, K-20825, and K-20856). Their stem heights vary between 59 and 68 cm, mass per 1,000 grains varies from 52 to 65.8 grams. In the standard Nosovskiy-6 these indicators are respectively 81 cm and 49.2 grams.

In the crossing of the fast-ripening, two-row variety Yuzhnyy with the late-ripening multi-row Akkamugi (Japan), F_1 showed a dominance of early ripening, two rows, and large grains; F_2 and F_3 showed forms which spiked 5 to 10 days earlier than the Yuzhnyy and surpassed both parent forms in terms of yield and grain size. This points to the possibility of combining fast ripening with plant productivity.

Of great value in selecting for resistance to root lodging are the varieties Mg. p. Molsgolden Plomos (England), Juli, Piri, and Cristal (Belgium), Britta, and Ammer, Aspa (FRG); resistance to stem lodging--Krasnodarskiy-35, Smelyanskiy, and Donetskiy-4 (under conditions of inadequate moisture), Martha (Austria), Pajbjerg-7/5-19, Lephyr, Sultan, Mazurka, Delisa (Holland), Hadmerslebener-23174/63 and Astakus (GDR), 7/5-19 x Vada-4 (Denmark), Centennial, and Paragon (Canada), Nordlys and Lise Vigdis (Norway), Peroga and Union (FRG), Jo-0764 and Jo-0808 (Finland), Kristina, Hellas, Kwan-CB-6040, CB-65514, CB-64505, and Cilla (Sweden), Secura (Switzerland), and Schwanneck (South Africa). Complex resistance to both root and stem lodging characterizes the Kwan variety and lines we isolated. In 1973 and 1974 these samples did not lodge despite abundant rains and strong winds; their resistance rating was five points, while the others lodged severely.

To determine the most valuable immune initial material we are also studying the spring burly collection of a provocation background--that is, it is sown together with winter barley at late times; this permits an evaluation during years of mild disease.

As a result of studying the samples on a provocation background, we isolated only 10 percent of varieties practically resistant to powdery mildew. They include K-11542 (Yemen), K-21547, 21548, 21557 (Bolivia), Aramir, Mazurka, Iulia, Effendi, Ofir, Belfor, Emir, and C.I.V.312-8 (Holland), Hadmerslebener-46566/68, Hadmerslebener-51651/61, Hadmerslebener-49250/69, and Heisa (GDR), Caho C. I.-13852 (United States), Franken-111, Union, Ammer, Aspa, Voldagsen, Hor. 1104, and Gerda (FRG), and 6208 and CB-65522 (Sweden). The standard varieties were severely affected by powdery mildew on this background (Nosovskiy-6 and Nutans-244 were 2 to 3 points, Yuzhnyy was 3 to 4 points). High resistance to this disease was also manifested by these samples on an ordinary background during the entire time they were studied at the station.

High field resistance (infection rate 0 to 1 points) to leaf rust characterized Legia and Piri (Belgium), K-21546, K-21517, and K-21549 (Bolivia), Belfor and C.T.V.100 (Holland), Asse, Rikax F_1, Gandar, C-1-1237, and Crusat C-I-6482 (FRG), K-20846, K-20850 (Tunisia), K-20762, K-20764, K-20769, K-20777, K-20780, and K-20782 (Morocco), Iane C.I.13198, Wood Vade C.I.13813 (United States), and K-21581, and K-21627 (Ecuador). Infection of these samples in most cases varied between 2 and 4 points, while that of the standard (Yuzhnyy and Nosovskiy-6) ranged between 2 and 3. In the case of reticular helminthosporiosis--Masson (England), Impala (Holland), K-21653, K-21654, and K-21656 (United States), Caris (FRG), Ceres-795 (Tunisia), Rupal (Sweden), Bocen (Zechoslovakia), and K-21605, K-21606, K-21619, and K-21639 (Ecuador). Very limited in number were varieties having complex resistance to powdery mildew and leaf rust. They included Belfor and Julia (Holland), Legia, Cristal (Belgium), and Asse, Gandar, and Aspa (FRG).

For selection to boost productivity, the most interest attached to Nutans-244, Volynskiy (pr.-4325), Jnis (pr.-3447), Iuli (K-20506), Legia (K-20908), Lilly (K-20909), Dauphine (K-20910, Piri (K-20911), Cristal (K-20912), Mami (pr.-3419), Berac (K-20480), Crusader (K-20914), C.[illegible].V.-312-8 (pr.-5063), Impala (K-19663), Cambrinus (K-19571), Belfor (K-2048[illegible] [illegible]ffendi (K-21873), Ofir (K-21874), Aramir (K-21875), Lofa Abed (K-20490), 4/[illegible]-27 x Vada^{6} (pr.-3326), 7/5-19 x Vada^{1} (pr.-3320), Caho C.I.13852 (K-21650), Dukat (K-21857), Secura (K-20915), and Cilla (K-20866).

In terms of grain yield, they surpassed the standard Nosovskiy-6 by 10.2 to 69.1 percent in the collection nursery; in the control, the yield of some of them varied between 50.2 and 60.7 quintals per hectare. This is 4.6 to 15.1 quintals higher than the average standard yield. They include Nutans-244 (USSR), Juli (Belgium), Ofir and Aramir (Holland), Jnis (England)--55.6 quintals per hectare; Toplani (Hungary)--56.8; Impala (Holland)--53.7; lines derived from Zephyr samples (Holland)--57.2; and pr.-3325 (Denmark)--56.8. In terms of grain yield they surpassed the standard Nosovskiy-6 by 1.2 to 2.8 quintals per hectare.

The varieties produced high grain yields--43.5 to 45 quintals per hectare--in both station tests and under production conditions. Thus, on Zarya Kommunizma Kolkhoz (Globinskiy Rayon) they surpassed the Nosovskiy-6 by 4.5 to 6 quintals per hectare.

In most cases, the derived varieties combined high yields with resistance to lodging and diseases.

Some of them are highly responsive to moisture: Lofa Abed (Denmark), Belfor, CIV-312-8 (Holland), Dauphine, and Cristal (Belgium), KMA-35/69 (Czechoslovakia), Yantar' (Czechoslovakia), Hellas and Cilla (Sweden), and Secura (Switzerland). Of great importance for conditions of the wooded-steppe zone are the drought-resistant varieties. The frequent appearance of spring and summer droughts sharply reduces yields, in some years--1975--almost by half.

On backgrounds of severe drought, the following varieties are of definite interest as initial material for selection to increase spike productivity: K-21535, K-21537, K-21540, K-21545, K-21552, K-21563, and K-21566 (Bolivia), and K-21864 (United States). The grain mass on the main head in these varieties varied between 1.23 and 1.62 grams. This is 50 to 97.6 percent higher than the standard Nosovskiy-6.

Increased protein content in the grain--15.2 to 22.2 percent--distinguished the samples Il'inetskiy-43, Donetskiy-4 (USSR), K-19941 (Algeria), Hadmerslebener-23174/63 (GDR), Gorzowski-362 (Polland), Io-0808 (Finland), and Hiproly (United States).

In terms of particular traits, the variety samples we derived can be used as initial material for selective breeding.

6854
CSO: 1870

AGROTECHNOLOGY

UDC 633.11"324":631.526.32

HIGH-YIELD VARIETY OF WINTER WHEAT

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 2, 1979 p 34

[Article by Candidate of Agricultural Sciences L. A. Burdenyuk]

[Text] Starting with 1979, the new Belotserkovskaya-177 variety of winter wheat is zoned for the lowland area of Zakarpatskaya Oblast. It was developed at the Belaya Tserkov' Experimental-Selection Station by the complex hybridization technique (Belotserkovskaya-198 x Belotserkovskaya-23) x (Bezostay-1 x Belotserkovskaya-198). It belongs to the wooded-steppe southern (Ukrainian) ecological group. It belongs to the erithrospermum variety. The spike is white awned, spindle-shaped, large, of medium density, with glabrous glumes; the grain is red, large, full; 1,000 seeds weigh 45 to 53 grams.

It is a medium-ripening variety, maturing at the same time as the Mironovskaya-808. The stem is strong, of medium height, medium-resistant to lodging, and during the ripening stage the straw takes on an anthocyanic tint. It is resistant to powdery mildew and yellow rust and relatively resistant to brown rust. During the years of competitive testing (1971-1973), the disease affected 18 percent; for Mironovskaya-808 the figure was 45 percent.

The variety has high winter-hardiness. Research between 1972 and 1977 showed that starting in the autumn, Belotserkovskaya-177 accumulates the same quantity of sugars in the tillering nodes (45.2 percent) and consumes them just as economically during the wintering period as the Mironovskaya-808, but its tissues are more water-laden, and its winter-hardiness is somewhat lower than in the latter period.

Belotserkovskaya-177 is relatively resistant to root rot. According to 1974 data, infection of it by this disease stood at 13.1 percent; the figure for Mironovskaya-808 was 15.5, for Bezostay-1--37.3 percent.

The maximum yield--84.2 quintals per hectare--was produced on the Mukachevo Variety Testing Plot in Zakarpatskaya Oblast in 1976 following corn (the yield gain compared with the standard Mironovskaya-808 was 2.7 quintals per hectare); following perennial grasses--82.6, following Mironovskaya-808 --68.2 quintals per hectare. On the Andrushevka Variety Testing Plot in Zhitomirskaya Oblast, Belotserkovskaya-177 that same year yielded 57.6 quintals per hectare, surpassing Mironovskaya-808 by 10.5. In 1977, on the Zhmerinka Variety Testing Plot in Vinnitskaya Oblast, the yield was 55.0 quintals per hectare, surpassing the Mironovskaya-808 by 6.6; it surpassed the Il'ichevka by 3.1; on the Kalinovka Variety Testing Plot the yield was 54.5 quintals per hectare, the gains constituting respectively 6.7 and 4.0.

The variety has successfully undergone production testing. In 1977 on Kolkhoz imeni Lenin (Mukachevskiy Rayon) it yielded an average 43.3 quintals per hectare, surpassing the standard by 8.6.

The new variety has excellent baking qualities. According to data from the State Commission's Technology Laboratory, in 1977 the grain contained 13.5 percent raw protein; the flour contained 29.5 percent gluten, the flour strength was 336 joules, and the volume of bread per 100 grams of flour was 1,040 cubic centimeters; for the standard Mironovskaya-808 the respective figures were 12.9 percent, 28.0 percent, 274 joules, and 1,045 cubic centimeters.

To produce high yields with the new variety, we recommend the following cropping techniques. The crops should be planted following perennial grasses, green feed, and legumes, because in the western regions of the Ukraine, where the variety has good potential, droughts do not generally occur.

Presowing cultivation of the soil depends on the predecessor and the moisture reserves. The main requirement is that all of the work must be done on schedule and on a high level of quality. This is important not only for producing even sprouts and good plant development in the autumn but also for good wintering.

The seed should be planted during the first 10 days of September in well-prepared soil, at a depth of four to five centimeters during wet years and six to eight centimeters in dry years.

Belotserkovskaya-177 responds well to increasing the area of plant nutrition, and for this reason the seed planting norm--4.5 to 5 million seeds per hectare --should not be increased. If the crops are too dense, the variety will lodge, the size of the spike is smaller, and the crop yield is lower.

Mineral fertilizers should be applied at the time of the main plowing; they improve the plants' development in the autumn and promote the accumulation of sugars in the tillering nodes and, consequently, create the best wintering conditions.

6854
CSO: 1870

AGROTECHNOLOGY

UDC 633.1:631.53.02:631.165

FACTORS DETERMINING THE CAPACITY OF AN INTERFARM SEED-TREATMENT PLANT

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 2, 1979 pp 41-44

[Article by Candidate of Economic Sciences Ye. Ye. Yefimchik, Belorussian Scientific-Research Institute of Economics and Organization of Agriculture]

[Text] In converting grain crop seed raising to an industrial basis, great importance attaches to problems of optimalizing the dimensions and placement of seed-treatment enterprises, because post-harvest treatment of the seeds is a very labor-intensive process.

Determination of the dimensions (capacity) of seed-treatment plants and their most rational territorial placement are conditioned by many factors: The level of social outlays in enterprises of differing capacity, conditions governing the cultivation, transport, storage, and sale of the seeds, and others. These can be divided into intra-production and extra-production factors.

The most important intra-production factors include social outlays on post-harvest treatment of the seeds, expressed in the prime cost of the treatment and one-time capital investments.

An analysis of existing seed-treatment plant projects confirms a general tendency for economic indicators to improve as capacities rise (Table 1).

Despite the increase in the total volume of capital investments, as the plants are made larger the operating and labor outlays on treatment and storage go down, and specific capital investments are also reduced.

The present dependency between plant capacity and operating and specific capital outlays makes it possible to determine the missing values of these indicators for enterprises of varying capacity: 2,500, 5,000, 7,500, 10,000, 15,000, 20,000, 25,000, 30,000, 35,000, and 40,000 tons.

The nature of the change for both indicators is the same: At first they decline intensively and then more smoothly, with a marked tendency to approach the limit. This regular change in function can be represented by the formula:

Table 1. Dependency of Economic Indicators of Seed-Treatment Plants on Their Capacity

(1) Показатели	(2) Мощность завода (тыс. т в сезон)			
	2,5	5,0	10,0	25,0
(3) Номер проекта	166	1001	1002	экспериментальный (9)
(4) Капиталовложения (тыс. руб.)	527	936	1487	2000
(5) Удельные капиталовложения (руб/т)	211	187	149	80
(6) Затраты на обработку и хранение:				
(7) руб/т	20,4	18,8	14,4	10,7
(8) чел.-ч/т	8,9	5,7	3	нет данных (10)

Key:

1. Indicators
2. Plant capacity (thousands of tons per season)
3. Project number
4. Capital investments (thousands of rubles)
5. Specific capital investments (rubles per ton)
6. Outlays on treatment and storage
7. Rubles per ton
8. Man-hours per ton
9. Experimental
10. No data

$$so = A \cdot e^{-\lambda Q} + B$$

where so represents specific outlays (rubles per ton); e represents the base of the natural logarithm (2.718); Q is the plant's capacity (thousands of tons per season); A, λ, and B represent constant coefficients depending on the type of outlays.

For determining operating outlays (C) and specific capital investments (K), we use the equation:

$$C = 14.3 \cdot e^{-0.104Q} + 9.58;$$

$$K = 201.22 \cdot e^{-0.0912Q} + 60.01.$$

The reduction in operating outlays and specific capital investments still does not prove the effectiveness of the largest seed-treatment enterprises. The process of concentrating production and improving its effectiveness on this basis has definite limits.

Industry experience (L. M. Gatovskiy, Ya. G. Feygin, and R. S. Livshits) also indicates that not all large enterprises are characterized by high economic indicators. This is confirmed in the data of Table 2, which shows that the increase in the capacity of the seed-treatment plants runs ahead of the rise in capital investments, while the prime cost of treatment and specific capital outlays go down compared with the preceding variant.

But while all these indicators go down when capacity is increased, when the level passes 30,000 tons the amounts become insignificant (within the limits of calculation error). This indicates that in Belorussia increasing plant capacity above 30,000 tons yields practically no effect.

Extra-production factors influencing the capacities of seed-treatment enterprises include the transport outlays necessary to deliver the grain peas to the plant and the conditioned seeds to the consuming farms.

Our investigations have made it possible to determine the dependency of the average haulage distances of grain peas and conditioned seeds on enterprise capacity and other factors:

$$L_p = K_1 \cdot K_2 \sqrt{\frac{Q}{y \cdot d \cdot K_3}} \quad ;$$

$$L_s = K_1 \cdot K_2 \sqrt{\frac{Q}{H \cdot d \cdot K_4}} \quad ,$$

where L_p and L_s are the average radii of haulage of peas and ready seeds, respectively (km); Q is the seasonal productivity of the plant (quintals); y is the seed yield (quintals per hectare); H is the weighted average sowing norm (quintals per hectare); d is the proportion of grain crops in the total territory (percent); K_1 is the coefficient of road curvature; K_2 is the curvature of terrain configuration and location of the seed-treatment plant; K_3 is the coefficient of the output of clean seeds; K_4 is the coefficient of reserve seed stocks.

Transport outlays can be determined by the following formula:

$$T = a + a_1 L ,$$

where T represents outlays on transporting the grain (rubles per ton); L is the haulage distance (km); a and a_1 are the coefficients of linear dependency which, in Belorussia's conditions, are respectively 0.1 and 0.09 when using dump trucks of the GAZ-53V type (K. M. Kavalerchik, "Determining the Optimal Productivity of Grain Cleaning and Drying Complexes" in: "Voprosy ekonomiki i organizatsii sel'skokhozyaystvennogo proizvodstva" [Problems of the Economics and Organization of Farm Production], Minsk, Uradzhay, 1971).

Table 2. Effectiveness of Concentration of Post-Harvest Grain Crop Seed Treatment

(1) Показатели	(2) Мощность предприятия (тыс. т в сезон)									
	- 2.5	5.0	7.5	10.0	15.0	20.0	25.0	30.0	35.0	40.0
(3) Прирост мощности в сравнении с предыдущим вариантом (%)	—	100	50	33.3	50	33.3	25	20	16.7	14.3
(4) Капиталовложения (тыс. руб.)	574	940.7	1183.2	1347.5	2580.5	1788.4	2016.7	2275.2	2563.7	2869.6
(5) Прирост капиталовложений в сравнении с предыдущим вариантом (%)	—	63.9	25.8	13.9	17.3	13.1	12.8	12.8	12.7	12.0
(6) Опережение прироста мощности относительно капиталовложений (%)	—	36.1	24.2	19.4	32.7	20.2	12.2	7.2	4.0	2.3
(7) Удельные капиталовложения (руб/т)	229.6	188.1	157.8	134.7	105.4	89.4	80.7	75.8	73.2	71.7
(8) Себестоимость обработки семян (руб/т)	20.86	18.15	16.08	14.57	12.50	11.34	10.70	10.32	10.10	9.98
(9) Снижение удельных капиталовложений в сравнении с предыдущим вариантом (%)	—	18.0	16.1	14.6	21.8	15.1	9.9	6.0	3.4	2.1
(10) Снижение себестоимости в сравнении с предыдущим вариантом (%)	—	13.0	11.4	9.4	14.2	9.3	5.6	3.5	2.1	1.2

Key:

1. Indicators
2. Enterprise capacity (thousands of tons per square season)
3. Increase in capacity compared with preceding variant (percent)
4. Capital investment (thousands of rubles)
5. Increase in capital investments compared with preceding variant (percent)
6. Rate at which increase in capacity surpasses capital investments (percent)
7. Specific capital investments (rubles per ton)
8. Prime cost of seed treatment (rubles per ton)
9. Reduction in specific capital investments compared with preceding variant (percent)
10. Reduction in prime cost compared with preceding variant (percent)

Table 3 shows the outlays on hauling peas to plants of differing capacity and production conditions.

Table 3. Outlays on Transporting Peas Depending on the Capacity of the Seed-Treatment Plant, its Location, and Conditions Under Which the Seed Stock Is Cultivated (Rubles per Ton of Seeds)

(1) Варианты размещения (K_2)	(2) Удельный вес зерновых в общей площади (%)	(3) Урожай (ц/га)	(4) Мощность предприятия (тыс. т в сезон)									
			2,5	5,0	7,5	10,0	15,0	20,0	25,0	30,0	35,0	40,0
(5) При концентрации семенных посевов вокруг завода												
0,489	7,8	35	0,87	1,19	4,44	1,64	1,99	2,22	2,54	2,77	2,99	3,19
0,489	12,6	35	0,71	0,96	1,15	1,32	1,59	1,82	2,02	2,20	2,37	2,53
0,489	17,6	35	0,61	0,83	0,99	1,13	1,36	1,55	1,72	1,90	2,02	2,15
0,489	21,9	35	0,56	0,75	0,90	1,02	1,23	1,40	1,56	1,70	1,82	1,94
0,489	12,6	25	0,82	1,12	1,34	1,54	1,86	2,13	2,37	2,59	2,79	2,97
0,489	12,6	45	0,64	0,86	1,03	1,17	1,41	1,61	1,79	1,95	2,10	2,24
0,950	12,6	35	1,29	1,78	2,16	2,47	3,01	3,46	3,85	4,21	4,54	4,85
(6) При рассредоточенном размещении семхозов												
0,489	12,6	35	1,71	2,37	2,88	3,31	4,03	4,64	5,18	5,66	6,10	6,52
0,950	12,6	35	3,30	4,53	5,52	6,36	7,77	8,96	10,0	10,95	11,82	12,63

Key:

1. Placement variants (K_2)
2. Proportion of grain in total area (percent)
3. Yield (quintals per hectare)
4. Enterprise capacity (thousands of ton per season)
5. Concentration of seed crops around plant
6. Dispersed placement of seed farms

Table 3 shows clearly that outlays on delivering the peas are lower in that group of rayons where yields are higher and the proportion of grain crops is larger, and substantially higher where specialized seed farms are dispersed.

Similar changes characterize outlays on delivering conditioned seeds to the consumers.

Calculations show that for Belorussia H = 2.25 quintals; $K_1 = 1.5$; $K_3 = 0.67$; $K_4 = 1.25$.

Coefficient K_2 varies depending on the configuration of the terrain in the raw materials zone and the location of the plant in it. For example, where the territory is in the form of a circle and the plant is placed in the center the case $K_2 = 0.367$; in the case of a rectangle it ranges between 0.419 and 1.601 depending on the location of the plant.

It is essential to select the proper K_2 for each specific case, because it is impossible to know before hand the form of the raw material or consumer zone.

The best variant in terms of reducing transport outlays will be to construct the interfarm plant in the center of the raw material and consumer zones. K_2 will be only half as much as in the case of less desirable placement of the enterprise, and transport outlays will be cut almost in half. In practice, however, it is necessary to take account of other factors that may influence the selection of the plant's placement (available manpower, access roots, and so on).

The proportion of grain crop plantings in the total territory--d = 12.6 percent--approximately corresponds to the republic's average conditions. But there are groups of rayons in which d is lower (7.8 percent) or higher (17.6 and 21.9 percent).

In terms of the economy, therefore, the criterion of optimality in determining the rational level of concentration of post-harvest seed treatment at interfarm plants should be the minimum total operating and one-time capital outlays on treatment and storage of the seeds and transport costs to haul the peas to the plant and the finished product to the consumers. It is also essential to take account of investments in transport facilities, because increased enterprise capacity requires more and more automotive transport.

The results of summarizing all types of outlays (operating, one-time, and transport) depending on the capacity of the seed-treatment enterprise, production conditions, the transporting of the peas and ready seeds, and location of the plants, are shown in Table 4.

Where the seed farms are concentrated and the plant is located in the center of the territory (K_2 = 0.489) and the proportion of grain crops is 12.6 percent or more of the total area, the minimum reduced outlays obtain for enterprises of 30,000 tons capacity. Where the proportion of grain crops is lower, plants of 25,000 tons capacity will be optimal. In the case of dispersed placement of specialized seed farms within the rayon, total outlays will be lowest with a plant of 20,000 tons capacity.

If, however, the territory is stretched out and if because of additional limitations it is necessary to select a less desirable variant of plant location (K_2 = 0.950), the plant's capacity in the case of concentrated seed farm location will be 20,000 tons per season; in the case of dispersed location--15,000 tons.

These data permit the conclusion that optimal dimensions of grain crop seed treating enterprises in our republic will vary depending on specific conditions.

Table 4. Dynamics of Reduced Outlays Depending on the Capacity of the Seed-Treatment Enterprise and on Conditions of Transport and Location (Rubles per Ton of Seeds, Given Yields of 35 Quintals per Hectare)

(1) Вариант размещения завода (K_2)	(2) Удельный вес посевов зерновых (%)	(3) Мощность предприятия (тыс. т в сезон)									
		2,5	5,0	7,5	10,0	15,0	20,0	25,0	30,0	35,0	40,0
(4) При концентрации семенных посевов вокруг завода											
(5) 0,489	7,8	52,97	46,78	42,29	39,04	35,20	33,57	33,17	33,35	33,87	34,82
То же	12,6	52,07	45,65	40,90	37,42	33,19	31,27	30,58	30,50	30,82	31,49
» »	17,6	51,51	45,00	40,1	36,48	32,18	29,95	29,10	28,97	29,08	29,61
» »	21,9	51,35	44,61	39,64	35,94	31,41	29,20	28,29	27,94	28,10	28,52
0,950	12,6	54,91	49,69	45,85	43,13	40,16	39,37	39,6	40,37	41,39	43,04
(6) При рассредоточенном размещении семхозов											
0,489	12,6	54,14	48,57	44,47	41,07	37,65	31,12	37,12	37,71	38,57	39,99
0,950	12,6	58,97	55,36	52,82	51,14	50,01	50,74	52,51	54,35	56,52	59,03

Key:

1. Variant of plant location (K_2)
2. Proportion of grain crops (percent)
3. Enterprise capacity (thousands of tons per season)
4. Concentration of seed crops around plant
5. 0.489
6. Dispersed placement of seed farms

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CSO: 1870

AGROTECHNOLOGY

UDC 631.18:631.53.02

HOW TO PRODUCE HIGH-QUALITY RICE SEEDS

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 2, 1979 pp 51-54

[Article by V. P. Konokhova, Leading Agronomist, USSR Ministry of Agriculture Main Administration of Grain Crops and General Problems of Land Cultivation, Candidates of Agricultural Sciences A. I. Aprod and V. V. Ptashkin, Candidate of Technical Sciences Z. I. Ballod, and A. N. Zinnik, junior scientific staff member, All-Union Scientific-Research Institute of Rice]

[Text] It is possible to produce high-quality planting stock only by making correct and rational use of the entire complex of agrotechnical measures involved in the cultivation, post-harvest treatment, and storage of seeds. It is also necessary to create a soil fertility background that is optimal for each variety.

It is best to place rice seed crops on a bed of perennial grasses, bed rotation, and occupied fallow. For this reason, on seed farms it is advisable to introduce short-rotation cycles: The first and second year--grasses, the third and fourth years--rice; or, the first year--occupied fallow, second and third--rice.

Mineral fertilizers must be applied depending on the predecessor and the variety being cultivated. When planting after perennial grasses: The first year--$N_{60}P_{90}K_{45}$; the second--$N_{90}P_{90}K_{60}$; the third--$N_{120}P_{120}K_{90}$. In the case of occupied fallow: The first year--$N_{90}P_{90}K_{60}$; the second--$N_{120}P_{120}K_{60}$; the third--$N_{150}P_{150}K_{90}$. For varieties of the Kuban'-3 type, which are not very responsive to nitrogen fertilizers, nitrogen doses should be reduced by 20 to 30 percent compared with the more responsive Krasnodarskiy-424 type.

It is very important on seed crops to maintain the proper balance (1:1) between dosages of nitrogen and phosphorus fertilizers. Nitrogen yields the best effect when applied in small doses with several applications: Fifty to sixty percent of the total planned dosage before planting, the remainder applied as a top dressing on the sprouts, at the start of tillering, and during the period of formation of eight to ten leaves or fifteen to twenty days prior to tasseling, when the formation and growth of the spikelets take place.

It is possible to produce good seed yields by sowing seed of class 1 and class 2 with a germination rate of 90 percent or more (seed of class 3 reduces the field germination, leading to 10 to 15 percent lower yields and overconsumption of planting stock--50 to 60 kilograms per hectare compared with seed of class 1).

The best time to begin sowing in most of the country's rice-farming areas is between the third 10 days of April and the first 10 days of May, when the soil temperature warms up to 12 to 14 degrees C at implantation depths of 3 to 5 cm. Especially good results are achieved in early (April) sowing, with seeds planted 4 to 6 cm deep in the soil. If planted later, the seeds do not manage to ripen fully and do not have very good planting qualities.

In order to improve field germination, seeds that have been cooled during the winter should be heated by warm air in the storage lots, the warehouses, the hoppers, and the grain driers three to five days prior to sowing; they should be treated with granosan two to three days prior to sowing.

The seed planting norm should be differentiated depending on soil fertility: On fertile, meadow-chernozem soils, five million seeds per hectare constitute the optimum; seven million per hectare are optimal for peaty-gley soils of low fertility. Increasing the norm to nine million seeds per hectare or more is not advisable either for producing seed or food grain (Table 1).

To accelerate the reproduction of zoned elite seeds, also promising varieties, wide-row sowing is recommended (30 cm between rows), with sowing norms of 3 to 3.5 million per hectare; this makes it possible to double the reproduction coefficient and reduce planting stock consumption (Table 2).

Wide-row sowing creates favorable conditions for productive tillering of the plants from the axils of the lower level of the leaves; this makes for simultaneous ripening of the seeds on the main and lateral panicles. In addition, such planting facilitates high-quality weeding without damaging the plants, increases their resistance to lodging, and makes for better ventilation, thus reducing the threat of pyriculariosis and promoting better seed quality.

When basic cropping techniques are not carried out, seed crops become contaminated with various impurities. Posing a special danger are the red-grain forms, which reduce the yield and impair the grain's technological qualities. These forms shed strongly, are highly productive and resistant to unfavorable environmental conditions, and bush out strongly. A single seed can yield progeny of 1000 to 1500 seeds; their presence in the seed plantings leads not only to contamination of the planting stock but also the soil. Because of this, thorough weeding is absolutely essential. If it is not done, the number of red grains in the planting stock the next year will increase by five to ten times.

Table 1. Influence of Sowing Norm on Krasnodarskiy-424 Rice Seed Yields When Cultivated on Soils of Varying Fertility (Data of All-Union Scientific-Research Institute of Rice for 1975-1977)

(1) Норма высева семян (млн. шт/га)	(2) Лугово-черноземовидная почва		(3) Торфяно-глеевая	
	(4) урожай (ц/га)	(5) коэффициент размножения	(4) урожай (ц/га)	(5) коэффициент размножения
3	84,3	64,3	27,0	22,1
5	84,4	73,9	34,4	28,6
7	81,6	74,8	46,4	39,5
9	80,6	72,8	40,3	32,6
$\bar{x}$	2,7	2,6	1,6	5,1
(6) $НСР_{05}$	8,1	6,5	1,6	4,1

(7) Примечание: на участках размножения элиты норма высева семян 4—5 млн. шт/га.

Key:

1. Seed sowing norm (millions per hectare)
2. Meadow-chernozem soil
3. Peaty-gley
4. Yield (quintals per hectare)
5. Reproduction coefficient
6. NSR_{05}
7. Remark: On elite reproduction plots, seed planting norms are four to five million per hectare.

Red-grain forms tassel sooner, as a rule, and on plantings of awnless varieties they can be removed in the early stages (at the beginning of waxy ripeness). On plantings of awned varieties, however, thorough weeding must begin at the start of full ripeness when it is easy to determine the color of the flowering glumes and awns.

At present, to prevent contamination of high-grade varieties with red-grain forms the following agrotechnical measures are used: Stimulation of the sprouts in order to destroy them, cultivation of the soil under water, burning of the stubble, thorough weeding, selection of varieties and predecessors, also screening the seed grain on screens and triurs. The screens that are used have oblong openings of 2.5 by 20 and 2.2 by 20 mm; the triur mesh is 6.3 mm. Research at the institute has shown that the use of the latter makes it possible to remove 50 to 60 percent of these impurities.

Table 2. Influence of Sowing Techniques on Yield and Reproduction Coefficient of Seeds of Two Varieties of Rice Sown at the Rate of 3.5 Million Per Hectare (Data From All-Union Scientific-Research Institute of Rice)

(1) Способы сева	(2) Урожай (ц/га) 1969 г.	1970 г.	1971 г.	1972 г.	(3) в среднем за четыре года	(4) Коэффициент размножения семян (в среднем за четыре года)
(5) Дубовский 129						
(6) Рядовой (контроль)	40,5	53,1	56,6	34,0	46,1	14,0
(7) Широкорядный	37,7	56,4	52,1	33,0	44,8	26,8
(8) Кубань 3						
(6) Рядовой (контроль)	36,4	64,4	53,8	55,7	52,6	18,2
(7) Широкорядный	31,1	71,4	55,0	55,0	53,1	3[illegible],8
(9) Краснодарский 424						
(6) Рядовой (контроль)	57,5	69,0	62,0	62,2	62,7	20,5
(7) Широкорядный	68,8	61,0	55,4	61,3	61,6	41,1

Key:

1. Planting techniques
2. Yield (quintals per hectare)
3. Four-year average
4. Seed reproduction coefficient (Four-year average)
5. Dubovskiy-129
6. Row (control)
7. Wide-row
8. Kuban'-3
9. Krasnodarskiy-424

The quality of the seed stock largely depends on the harvesting times and techniques. Only the fully-ripened seeds have a high germination rate and seed vigor. When harvested during the waxy ripeness phase, they germinate slowly and the sprouts frequently die out, and the plants do not bush well. This is because of inadequate development of the germ. For this reason, it is essential to begin harvesting the seed crops at a time when at least 90 to 95 percent of the grains on the panicle are fully ripe.

It is also essential to thresh out the most full-bodied seeds with minimal damages.

The best harvesting technique for seed crops is direct combining, with preliminary desiccation with magnesium chlorate (25 kilograms of active ingredients per hectare). On farms where it is impossible to dry the standing crop, it is best to use the swath harvesting technique. With good weather, the windrows can be threshed three or four days after mowing. To produce high-quality seeds this can be done twice: First in the soft mode to separate 85 to 90 percent of the crop for seeds, then a second time on the hard remaining portion for commercial purposes.

After preliminary cleaning in pea cleaners (OVP-20, ZSM-50 and others), the seeds are sent to be dried. The drying techniques and conditions depend on the heat-resistance. It is lower where the moisture content of the seeds is high, and for this reason the maximum temperature should be 40 degrees C when the moisture content is 15 to 17 percent, 35 degrees at 18 to 20 percent, and more than 20 percent at 30 degrees.

It is best to dry the seed grain in an immovable bed in hoppers, chamber grain dryers, and in warehouses equipped with active ventilation systems. Because this job generally takes place in the fall, the air must be heated. The advantages of drying the seed with atmospheric and heated air are indicated by the data shown in Table 3.

Table 3. Effectiveness of Active Ventilation of Rice Seeds in VB-25 Hoppers With Specific Air Feed of 400 Cubic Meters per Hour per Ton (Data Averaged Over 1974-1976)

(1) Продолжительность вентилирования (ч)	(2) Влажность семян (%)		(3) Всхожесть семян (%)		(6) Производительность одного бункера (плановых т/ч)
	(4) до вентилирования	(5) после вентилирования	(4) до вентилирования	(5) после вентилирования	
(7) Температура теплоносителя (20°C)					
98	16,6	13,7	92	96	0,11
240	18,1	14,2	90	94	0,07
240	19,2	14,3	88	90	0,09
240	20,4	14,3	89	92	0,11
(8) Температура теплоносителя (40°C)					
24	15,5	11,8	90	95	0,92
21	16,3	12,7	90	95	0,88
48	20,4	12,6	88	95	0,84

Key:
1. Duration of ventilation (hours)
2. Seed moisture content (percent)
3. Germination rate (percent)
4. Before ventilation
5. After ventilation
6. Productivity per hopper (planned tons per hour)
7. Temperature of heat carrier (20 degrees C)
8. Temperature of heat carrier (40 degrees C)

Chamber dryers in which heated air is fed in from both sides make for uniform drying and shorten the drying time by 1.3 to 1.5 times. If the initial moisture content of the seeds is no more than 16 percent, it generally takes 12 to 24 hours to dry them. During this time, their post-harvest ripening is completed and in terms of germination they meet the requirements of class one planting standard regardless of the amount of specific air fed in. Moister seeds take 22 to 30 hours to dry, with air fed in at the rate of 300 to 600 cubic meters per hour per ton. During this time, they undergo post-harvest ripening, their seed vigor rises by five to nine percent and their germination rises by two to four percent. Drier productivity is increased by 0.11 planned tons per hour. Raw seeds with a moisture content of 17 percent or more must be dried at specific air feed rates of 400 to 600 cubic meters per hour per ton, because lower rates (200 to 300) reduce the seed vigor and germination.

When seeds are dried in shaft-type driers excellent results are achieved in a two-stage mode in which the heat-carrier temperature is 50 degrees C in the first zone and 60 degrees in the second.

The seed quality is retained best if the seeds are passed many times through the grain drier, with a rest interval of eight to ten hours. The rate of moisture removal should not exceed 2 to 2.5 percent per pass.

The most effective technique of grading the seeds is to separate them by thickness. This should be done on the OSM-3U, the Petkus-Gigant K-213; KZR-5, the ZAR-5, or other machine (depending on the variety), using sieves with rectangular openings of 2.2 by 20 and 2.0 by 20 mm.

How long the seeds retain their germination ability depends on the moisture content and the temperature (Table 4). The optimal figures are 13 percent and 0 degrees C respectively. Under such conditions, the seeds retain their laboratory and field germination and yield qualities on the standard level for more than 12 years.

For temporary preservation of freshly-harvested seeds with a moisture content of over 15.5 percent it is necessary to maintain their temperature at 7 to 10 degrees C. This will make it possible to retain class one germination for six to eight months.

The seeds' stability in storage largely depends on their variety characteristics. The main zoned varieties for this indicator can be divided into two groups: Stable--Dubovskiy-129, Primorskiy-10, UzROS-7, and Krasnodarskiy-424; Unstable--Kuban'-3, UzROS-269, and Donskoy-63. With a moisture content of 13 percent and a temperature of 20 degrees, seeds in group one retain their germination ability within class one for 15 to 20 months, those of group two retain it only 8 to 10 months.

The safekeeping of the seeds at minus temperatures also depends on their moisture content and variety. From - 5 to - 20 degrees C, the maximum is 15 percent. Seeds from Kuban'-3 and Dubovskiy-129 are more stable under minus temperatures.

Storage methods have a considerable influence on seed quality (Table 5). This must be taken account of in seed fund storage.

In Krasnodarskiy Kray, seeds stored in bulk one meter high retain their germination ability within the limits of class one planting standard for 18 months; class two--24; class three--26; in the case of sacks, the respective figures are 15, 19 and 43 months.

Table 4. Length of Retention of Seed Germination at Class One Level (GOST 10250-62) Depending on Their Moisture Content and the Temperature (Data From All-Union Scientific-Research Institute of Rice, Average for 1966-1977)

(1) Температура семян (°С)	(2) Влажность семян (%)			
	13,0	14,5	15,5	17,0
0	(3) Более двенадцати лет		(4) два года	(5) один год
10	три года (6)	два года (7)	шесть месяцев (8)	шесть месяцев (9)
20	один год (10)	шесть месяцев (11)	один месяц (12)	пятнадцать дней* (13)

(14) * При условии постоянного проветривания.

Key:
1. Seed temperature (degrees C)
2. Seed moisture content (percent)
3. More than 12 years
4. Two years
5. One year
6. Three years
7. Two years
8. Six months
9. Six months
10. One year
11. Six months
12. One month
13. Fifteen days*
14. *Under conditions of constant ventilation.

Table 5. Germination of Krasnodarskiy-424 Rice Seeds (percent) depending on the Method and Duration of Storage in Krasnodarskiy Kray (1974-1977 Average Data From All-Union Scientific-Research Institute of Rice)

(1) Способы хранения	(2) Длительность хранения (месяцы)							
	6	12	18	24	30	36	42	28
(3) Насыпью	96	95	95	92	81	44	31	2
(4) В мешках	96	96	91	84	70	32	13	0

Key:
1. Method of storage
2. Length of storage (months)
3. Bulk
4. In sacks

Reserve stocks should be built up from batches grown and harvested under favorable conditions.

At present, the main way to improve the effectiveness of rice seed farming is concentration and specialization, converting the operation to an industrial basis. The creation of specialized seed farms, outfitting them with modern equipment, and supplying them with qualified cadres will make it possible to work more effectively in adopting scientific applications and advanced experience in the production of high-quality seeds; this will make it possible to substantially boost gross harvests and improve the quality of the grain of this valuable crop.

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CSO: 1870

AGROTECHNOLOGY

UDC 633.11"321":631.53.02(574.11)

PLANTING TECHNIQUES, SOWING NORMS, AND REPRODUCTION COEFFICIENT OF SPRING WHEAT SEEDS

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 2, 1979 pp 54-55

[Article by Candidate of Agricultural Sciences B. V. Guranov and G. I. Myasnikova, honored agronomist, Kazakh SSR]

[Text] In Ural'skaya Oblast, considerable time passes between the zoning of a new variety and its wide adoption in production. One of the main reasons for this is the low reproduction coefficient of the seeds.

Data from a number of scientific-research institutions show that it is possible to raise this coefficient by using the wide-row planting technique and reducing the sowing norm. Far from reducing crop yields, this increases the output of conditioned seeds and improves their quality.

We decided to check the effectiveness of these techniques in that area. Between 1974 and 1977 we conducted special experiments with two zoned varieties at the Ural'sk Agricultural Experimental Station (Al'bidum-43 and Saratovskaya-40) by the procedure shown in the table.

The record plot area was 165 to 187.5 square meters; the experiments were conducted four times; the predecessor was corn. Yield data were subjected to mathematical processing by dispersion analysis.

The results of our research (see table) showed that the reproduction coefficient in wide-row plantings was considerably higher than on row plantings, even during wet years when the yields went down. In addition, less density of the crop stand created favorable conditions for producing large, fuller seeds, which in the long run increased the output of conditioned seeds. In dry years, which occur twice as frequently in West Kazakhstan, grain yields from wide-row plantings are equal to or higher than row plantings.

As for sowing norms, our research confirmed the advisibility of reducing them (to between 1.5 and 2.0 million seeds per hectare) in seed reproduction. Thus, for accelerated seed reproduction in Ural'skaya Oblast it is possible

Influence of Planting Technique and Sowing Norm on Reproduction Coefficient and Size of Seeds of Two Varieties of Spring Wheat (1974-1977 Average Data)

(1) Способы сева и нормы высева семян на гектар	(2) Альбидум 43		(3) Саратовская 40	
	(4) коэффициент размножения семян	(5) масса 1000 зерен (г)	(4) коэффициент размножения семян	(5) масса 1000 зерен (г)
(6) Сплошной рядовой (3,0 млн. шт.)	9,1	33,3	7,1	38,8
(7) Широкорядный:				
(8) с междурядьями 30 см (2,5 млн. шт.)	10,7	33,6	8,8	39,6
(9) с междурядьями 45 см (2,0 млн. т)	11,9	34,6	10,3	41,1
(10) с междурядьями 60 см (1,5 млн. шт.)	13,6	34,3	12,5	41,3
(11) ленточный с междурядьями 60 см + 15 см (1,8 млн. шт.)	12,3	34,4	11,9	41,1

Key:

1. Planting techniques and sowing norms (seeds per hectare)
2. Al'bidum-43
3. Saratovskaya-40
4. Reproduction coefficient of seeds
5. Mass of 1,000 grains (grams)
6. Continuous row (3.0 million seeds)
7. Wide-row:
8. Thirty centimeters between rows (2.5 million)
9. Forty-five centimeters between rows (2.0 million)
10. Sixty centimeters between rows (1.5 million)
11. Strip sowing with 60 centimeters + 15 centimeters between rows (1.8 million)

to recommend wide-row (with 45 and 60 centimeters between rows and sowing norms of 2.0 to 1.5 million seeds per hectare) and strip techniques. The somewhat higher labor outlays on cultivating the soil between the rows are recouped by more rapid adoption of the variety.

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CSO: 1870

AGROTECHNOLOGY

DIRECTIVE ON APPROBATION OF VARIETY CROPS

Moscow SELEKTISIYA I SEMENOVODSTVO in Russian No 2, 1979 pp 55-56

[Article by A. G. Krutov, chief specialist, USSR Sortsemprom]

[Text] In connection with the development of scientific-technical progress in crop seed farming and the conversion of this sector to an industrial basis, the USSR Ministry of Agriculture has approved a new directive on the approbation of variety crops, in force as of the beginning of 1979.

Preparation of the directive involved specialists of the ministries of agriculture of the union and autonomous republics, variety seed raising associations, and state seed inspectorates, staff members of scientific-research institutions, and also specialists of other subunits of the USSR Ministry of Agriculture. A number of fundamental changes have been introduced into this new document. In particular, it indicates who is to conduct field approbation and on what farms.

On the experimental-production farms of the scientific-research institutes and the training-experimental farms of the agricultural VUZ's and Tekhnikums, variety crops are to be approbated by the agronomist of the variety seed raising association or the oblast (kray) administration of agriculture or the ministry of agriculture of the autonomous or union republic (not on the oblast level), with the participation of the selective breeder for the relevant crops or the specialist of the division of primary seed farming.

On the elite seed farms the responsibility rests with the agronomist of the variety seed raising association or the oblast (kray) administration of agriculture or a staff member of the division of primary seed farming of experimental-production farms of scientific-research institutions or training-experimental farms of agriculture VUZ's and Tekhnikums, or the agronomist of the state seed inspectorate.

On specialized seed farms, the responsibility rests with the agronomist of the rayon administration of agriculture or the state seed inspectorate.

On perennial grass seed farms, the crop of which is turned over to the specialized seed raising associations and perennial grass stations, the responsibility rests with the agronomists of these associations or stations.

On corn seed farms, joint responsibility rests with the farm's seed agronomist and a representative of the rayon administration of agriculture and the farm's representative.

On the seed crew sections of large kolkhozes and sovkhoz departments, the approbation procedure remains unchanged.

The new directive for the first time stipulates the personal responsibility of farm managers, chief agronomists, and farm agronomists for carrying out measures on the approbation of variety crops and for the use of high-grade seeds strictly as stipulated.

The directive does not include forms for recording the results of approbation of variety crops in agricultural enterprises. This is due to the fact that in 1976 the USSR Ministry of Agriculture's Administration of Bookkeeping and Accountability published and sent to the ministries of agriculture of the autonomous and union republics the "Album of Registry Forms and Primary Bookkeeping Documents in Agricultural Enterprises" (Book No 4), to which are attached all necessary document forms for the approbation of variety crops as well as instructions on filling them out. These forms are to be used without change in all agricultural enterprises of the USSR Ministry of Agriculture system. Providing these blanks is the responsibility of the All-Union State Industrial Cost-Accounting Association Soyuzuchetizdat of the USSR Council of Ministers State Committee for Publishing Houses, Printing Plants, and the Book Trade.

The new directive includes changes with regard to the selection of sheaves (samples) and norms of spatial isolation of the crops. Substantial changes and additions have been introduced on maximum norms of variety typicality and xeniality for corn seed plantings and variety purity norms for oil and grain crops, also on the composition of foreign crops and wheats that are difficult to remove. For example, buckwheat plantings are judged unsuitable for seed purposes if they contain more than five percent wheat and barley or three percent Tartary buckwheat, whereas the previous directive did not stipulate these restrictions.

The following passage is also revised: "Admixtures of maple pea and vetch in pea plantings are not considered difficult to remove and are not normed if the seeds are to be used for feed crop purposes." Changes have also been made in allowable norms of smut diseases in crop seeds. Barley plantings (except for elite) are judged unsuitable for seed purposes and are rejected if their infestation by various species of smut totals more than five percent, and millet, similarly, is rejected if loose smut in it exceeds three percent.

The section "Feed Lupine" includes additions on the approbation of yellow, white and narrow-leaf feed lupine; it now permits a bitter plant content of up to 5 percent (instead of the 10 percent in the previous directive); it includes a calculation for determining indicators of variety purity, species impurities, and alkaloid content.

A passage has been added to the section "Sorghum," making it possible to determine the degree and extent of sterility in reproduction and hybridization; it establishes the maximum norm of contamination (not over two percent) by broom corn, Sudan grass, and sorghum-Sudan and inter-species hybrids.

Now added to the "Corn" section is granary approbation and the characteristics of keeping track of high-lysine seeds.

For soy, approbation is now possible without collecting sheaves by means of visual evaluation of the standing crop.

For oil poppies, tolerances have been raised for the occurrence of hulls with closed glumes and conditions for the approbation of opium poppies are excluded.

In the section "Perennial and Annual Feed Grass Seed Plants,) changes have been introduced with regard to maximum areas and the number of samples and stems for sheaf collection; also added is a paragraph indicating the most harmful weeds subject to quarantine; it discusses the characteristics of approbation of yellow sweet clover; it describes the characteristic distinguishing features of two varieties of wheat grass and three of quack grass.

Changes have also been introduced on industrial crops (hemp, ambary, sugar beets, and fiber flax) and potatoes.

In order to interpret the main provisions of the new directive and assure proper compliance with this document, specialists of the ministries of agriculture of the union and autonomous republics, variety seed raising associations, and state seed inspectorates should arrange appropriate courses of study for approbation officers.

6854
CSO: 1870

AGROTECHNOLOGY

RESEARCH IN THE GENETICS OF SEED FARMING

Moscow SELEKTSIYA I SEMENOVODSTVO in Russian No 2, 1979 pp 56

[Article by D. Ya. Yefimenko: "Expand Integrated Research Into the Genetic Principles of Seed Farming"]

[Text] In order to radically improve seed farming while converting it to an industrial basis it is essential to undertake a number of measures, one of which is the integrated study of the gentics of farm crop seeds and the adoption of its findings in production. This vital problem was the subject of an all-union conference organized by the VASKhNIL Department of Plant Husbandry and Selective Breeding at the Ukrainian Society of Geneticists and Selective Breeders imeni N. I. Vavilov, held in June 1978 at the Sumy Agricultural Experimental Station.

More than 30 reports on current problems of seed genetics and seed farming were presented at the conference, summarizing the results of research in this area and mapping out ways to develop it further.

The reports of Professors I. G. Strona and G. F. Nikitenko and Candidate of Biological Sciences V. K. Shcherbakov dealt with problems of seed genetics and their practical application in present-day seed breeding. Professor G. F. Naumov reported on techniques for enhancing seed viability by using extracts from sprouted crop seeds. N. I. Savchenko reported on the characteristics and prospective use of the spore-forming ability of the androecium of the higher flowering plants in farm crop seed breeding, also a method of calculating the ratio of parent forms in the mix (according to the quantity of pollen in the stamens of the pollinator) in producing hybrid seeds of winter and spring wheat, rye, corn, sugar beets, and sunflowers.

The conference passed a resolution to expand integrated research by scientific seed breeders, embryologists, and geneticists in problems of farm crop seed genetics. It also recommended that special attention be focussed on the genetic mechanism governing the formation of the seeds' yield characteristics, modificational variability and its role in seed-breeding practice, the genetic laws governing variety changes in the process of reproduction, and other problems. The conference also recommended the extensive testing and practical adoption of procedures proposed by N. I. Savchenko and G. F. Naumov. Because of increased volumes of seed production on an industrial basis, the proposal was made to review and revise procedures for primary seed raising. All of these measures will help to improve seed quality and boost production.

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CSO: 1870

GENETICS

UDC 576.8.095.5:575.133

THE ORIGINS OF EXTRACHROMOSOMAL FACTORS OF HEREDITY (PLASMIDS) IN BACTERIA

Leningrad ZHURNAL EVOLYUTSIONNOY BIOKHIMII I FIZIOLOGII in Russian No 2, 1979 pp 113-125

[Article by N.V. Domaradskiy, All-Union Scientific Research Institute for the Biosynthesis of Protein Substances, Moscow]

[Text] Summary

The current status of the problem of the origin of extrachromosomal elements of heredity in microorganisms is reviewed in the light of published data and other materials from the author's own investigations. The role of plasmids in the ecology of bacteria, their adaptive variability and evolution are analyzed. Extrachromosomal heredity in bacteria is viewed as a special case of inheritance in general.

Introduction

Extra-chromosomal heredity in bacteria must be viewed as a special case of extra-chromosomal or cytoplasmic heredity in general [1,2]. From this point of view, bacteria are not an exception to the number of other representative forms of living matter. Extra-chromosomal, or cytoplasmic, inheritance then is closely associated with the problem of parasitism or infectious heredity, to be precise; that is, with the hereditary changes brought about by the presence of bacteria or viruses in an organism (cells) [1,3]. For this reason, it is necessary to seek the answer to the question of the origin of the factors of extra-chromosomal heredity in bacteria within the theory of evolution.

When did the R plasmids appear?

Published materials pertaining to the factors of extrachromosomal heredity generally take up the question of the origin of the R plasmids which are responsible for multiple drug resistance in bacteria. The reason is easily understood: the fact of their discovery in the late 1950's has posed a threat to the idea of using antibiotics to combat infections. We recall that the tumultuous growth of a number of resistant bacterial forms is measured by the ever-increasing scales for the use of various drug compounds. We must not think, however, that plasmids originated only at the time when antibiotics were discovered. They have been found in bacteria collected even before the beginning of the antibiotic era and are encountered in parts of the world where antibiotics have not yet become widespread [4-9].

Some data on plasmid genetics

Starting with the data of transduction analysis and information about the spontaneous segregation of individual genes for resistance, Watanabe [10, 11] has suggested that the R plasmids consist of two different genetic components: the transfer factor (RTF) and the determinants of resistance (r-determinants). The transfer factor is responsible for the ability of bacteria to enter into conjugation and thereby determines the capacity to transfer plasmids from one cell to another. In essence, it plays the role of a sexual factor. At the same time, the r-determinants carry the genes which are responsible for the development of resistance to drug compounds.

It was initially assumed that the r-determinants were not capable of replication in and of themselves [11-14]. However, genetic [15] and physical chemical data [16-18] later became available concerning their ability to exist in the form of independent replicons controlled by their own inherent mechanisms in the various microbe species. Strains of enteric bacteria which have only the transfer factor [14, 15, 19, 20] or, conversely, only r-determinants [15] have been found in nature. In a situation where cells have r-determinants alone, conjugation does not take place and the r-determinants cannot be transferred to other cells. However, they can be mobilized for transfer if the transfer factor or other conjugative plasmids are introduced into the cells.

The available data on R plasmids pertains to representatives of the gram-negative bacteria and for the most part, to enterobacteria. A different picture is seen in staphylococcus. These microbes have a resistance to drugs (and other agents) brought about by the presence of nonconjugative plasmids while they lack the capacity for conjugation, although there other thoughts on this [21]. The genetic and evolutionary relationships between the plasmids of enterobacteria and syaphylococcus have not been studied yet [22], although, as Falkow suggests [9], they have occurred as a result of the parallel development of these totally unrelated bacteria.

It is important to stress that other plasmids and, more precisely, the factors of bacteriocinogeny, hemolysis, toxicogenesis and biodegradation are structured according to the same principles as the R plasmids; that is, they may be made up of transfer factors and determinants which determine the specifics of the respective plasmids. Once again, like the R plasmids, the plasmids enumerated sometimes lose the transfer factor or always exist in a nonconjugative form. The impression exists that all conjugative plasmids with well-known functions are similar to the so-called displaced sexual factors or the F'-factors [11, 15]. Based on this statement, it is impossible to give a general answer to the origin of plasmids. The question of the origin of the transfer factor, or sexual factors on one hand, and the various specific autonomous determinants on the other must be viewed separately.

Is it possible to believe that the transfer factor and sexual factors are one and the same thing?

The main thing that unites transfer and sexual factors is their ability to give to cells the property of becoming donors of genetic information, which is realized by means of the plasmid-dependent mechanisms of conjugation. In addition to this, there are substantial differences among them. The "classic" sex factors (F) are relatively easily incorporated into the chromosome of the host. In an integrated state, they bring about the transfer of a chromosome (or its fragments) in the cells of the recipient. The integrated sexual factors, or in any case, their tra-genes [23] appear last in the cells of the recipient (it is as though they play the role of a "pusher" for the chromosomal genes). The circle of secondary hosts for the F plasmids is quite small. Among the given types of bacteria, all the F plasmids belong to the same incompatibility grouping.

Insofar as the transfer factors entering the plasmid's make-up and resembling the R plasmids are concerned, their transition from an autonomous state into an integrated one is the exception rather than the rule. All of them belong to different incompatibility groupings. A number of plasmids communicate the ability to restrict and modify foreign DNA to bacterial cells. All, or nearly all of the transconjugants which produce the R plasmids, for example, acquire the property of becoming donors for these plasmids. A number of plasmids of this type remain in the cells in a repressed state. Finally, in any case, the circle of hosts for the plasmid R is more extensive than that for the plasmid F [9, 24-29].

At this point it is difficult to decide whether the differences noted are actually determined by the transfer factors as such or depend on the plasmids as a whole in which the transfer factors are incorporated.

Unfortunately, we do not know of any special studies which clarify the changes in the specific properties of the sexual factors during their associations with various nontransmissible replicons; of course, there are also no studies of RTF models. Nevertheless, based on analogies with moderated phages and other indirect findings, it is possible to state that there are a number of transfer factors. On the other hand, the list of the characteristics of the sexual factors is not an attibute of these genetic structures alone. In particular, there exist sexual factors that belong to other incompatibility groupings than the F factor. We also know that the sexual factors of Rhizobium lupini extend the chromosome by themselves during conjugation, entering the cells of the recipient first [30]; that is, they conduct themselves like the R plasmids.

If all of this is so, then why can we not accept the idea that there is no principle difference between the inherently sexual factors and the factors of transfer and that the terms "sexual factors" and "factors of transfer" should be used synonymously? Meynell et al. [31] are of a similar opinion, as is Anderson [32] who wrote that the various genetic determinants can be carried by the same factor of transfer and, conversely, the various sexual factors can carry the same determinants which determine the specifics of an appropriate plasmid. This latter ability has been recently re-emphasized by Datta [33].

To a limited extent, the given hypothesis is reinforced by the results of a comparative heteroduplex analysis of the F-factor in enteric bacilli and certain R plasmids from the FII incompatibility grouping [34]. It has been demonstrated that within the tra-operon range of both types of plasmids, there is a high level of DNA homology. At the same time, these results make it possible to accept the reason for the differences which determine the specifics of the plasmids. For example, the ability of the F-factor to be incorporated into a chromosome with a relatively high frequency can be explained by the presence of a number of IS-elements within it that are absent in the corresponding region of the DNA molecule of the R plasmids. We recall that the IS-elements are fixed series of nucleotides containing unknown genes that do not have any relationship to the function of incorporation; they are generally smaller than 2 kb [35].

We will dwell further on two postulates - the existance of many factors of transfer and their identity to sexual factors.

Sexual factors and bacteriophages

Attention has frequently been turned to the similarity between sexual factors and viruses, especially that of the moderate bacteriophages [15, 36-40]. The following characteristics which link sexual factors and the moderate phages together are generally stressed: participation in the transfer of chromosomal genes, autonomy in replication, optionality for cells, the ability to be incorporated into a chromosome and the ability to confer immunity against superinfection. Based on this, some moderate phages are considered to be plasmids [9, 11, 24, 28, 41]. It should be noted that it is not always possible to make a clear distinction between moderate and virulent phages, especially when comparing their capacity to transfer chromosomal genes [42, 43]. It is not surprising, then, that the role of extra-chromosomal factors of heredity is ascribed to all phages that resemble other viruses [44] and is even indicative of their ability to change into plasmids [45, 46] while the sexual factors are labelled "virus-like" agents [32].

The controversy over the interrelationships between plasmids and phages as well as their evolutionary link to the chromosome apparatus of cells essentially began at the moment plasmids were discovered in bacteria. Up until now, questions concerning the origins of viruses in general and all other extra-chromosomal elements were drawn into the orbit of discussion. It is hardly expedient to outline the course of the controversy in detail although some of its results can be expressed in the words of Luria and Darnell: "A virus residing in a cell over an extended period of time is virtually impossible to distinguish from a component of the cell. We will call a particle of this type a virus, plasmid or genome, depending on the nature of its activity which makes it observable" [38, p. 375]. This thesis is in keeping with the facts from which we started this survey. In the steps of a number of authors [1, 3, 22, 37, 47, 48], it is possible to state that plasmids, in the broad sense of the work, act as an intermediate link between heredity and infection as well as between chromosomal and non-chromosomal heredity.

Over the past few years, Brinton [49] has been a strong supporter of the concept of the virus nature of transmissive plasmids and the cilia associated with them. He views transmissive plasmids and cilia as epiviruses, that is, viruses which do not form extracellular virions and therefore are forced to infect cells during cellular contact.

Extra-chromosomal factors and the ecology of bacteria

From the outset we have stressed that the question of the origin of extra-chromosomal inheritance factors should not be answered in isolation from the question of their importance to bacterial life. Unfortunately, only one fact is known, as it were, that is indicative of the ecological advantages that bacteria obtain from the acquisition of extra-chromosomal inheritance factors. We are thinking here of the extensive distribution of the R plasmids. The importance of other extra-chromosomal factors must be judged on the basis of indirect findings. However, "completeness" is one of the characteristic properties of life systems realized at all levels of their structural and functional organization including, understandably, the molecular and cellular levels where the initial interactions of the material bases of heredity take place" [50, p 153]. By applying this these, we can confirm that the distributional frequency of extra-chromosomal factors reflects their role in the life activity of bacteria in no small way. Plasmids--both transmissive and nontransmissive--as well as the moderate phages are wide spread among the enteric microbes, the pseudomodads, staphylococci and sil bacilli. Conjugative plasmids are dominant among the gram-negative microbes.

Within this framework as drawn, two circumstances have attracted special attention.

1. The extent of the spread of lysogeny among various species of microbes such as among the bacilli, pseudomonads and vibrions, for example. Following Anderson [44], it may be said that the symbiosis of bacteria and moderate phages unconditionally reflects the close evolutionary connection between them and again points to the role of moderate phages as extra-chromosomal factors of heredity even though this cannot always be proven experimentally for each specific case.

2. Repeated reports of isolating crytic plasmids, that is, plasmids whose function has not yet been explained [22, 51-58]. We note one such curious

detail. Among the bacteria in which crytic plasmids have been observed, there are a large number of strains that have them. Additional carriers of genetic information are not likely to be retained in the cells for long periods of time if they were not needed. Developing methods to select them will aid in explaining the function of the cryptic plasmids in the transfer and retention of genetic information. The first steps in this direction were made by Kretshchmer and his coauthors [59]. It is extremely interesting that the cryptic plasmids in Bacteroides fragilis are the only extra-chromosomal elements that have been explained to date.

The opinion exists that any extra-chromosomal factors are determined primarily by the habitational environment of the hosts. Thus, Reaney [60] feels that the absense of conjugative plasmids among representatives of the Bacillus genus to some extent reflects the fundamental ecological differences that are imposed by the habitats of enteric bacteria and bacilli. Within the intestinal tract of vertebrates where large populations of enterobacteria exist in a liquid environment rich in nutrients, the opportunities for the transfer of genetic informa through direct cell-to-cell contact are vast. Different conditions occur in soil. The colloidal-corpuscular nature of soil structure and the variability of such factors as pH, temperature and the nutritive substrate are absolutely less suited to the maintenance of physical contact between cells. Here, the chances are greater that the transfer of genetic information from cell to cell will take place by means of the phage particles that are easily diffusible and disseminated in the environment. The ability of phages to live in spores [60] is a further reflection of this type of adaptation distinguishing bacilli from the enterobacteria. However, the effect of bacterial habitat on the types of extra-chromosomal factors of inheritance that predominate are, in fact, apparently much more complex than Reaney imagined [60]. We will look back at a few facts. Soil is the habitat for the majority of pseudomonads and one of these, Ps. putida, has its own conjugative plasmids [53].

A second point concerns the "star-forming" bacteria in which the transfer of genes occurs during the process of direct cellular contact where "star formation" in and of itself seems to facilitate conjugation [30]. Finally, pathogenic vibrios are related to the group of obligate parasites of man but the predominant extrachromosomal elements within them appear to be phages.

In regard to the spread of extra-chromosomal elements among the various groups of microorganisms, it is desirable to dwell on two aspects of this question.

The first concerns the inducibility of conjugative activity. The point here is that among the F-like plasmids, the genes of the tra-flagellae remain under a negative control [61]. This means, then, that the majority of the F-like plasmids of the wild type are generally found in a repressed state. Therefore, in a number of cases when plasmids have been found in a microbe without knowing the conditions for the induction of the particular systems of transfer, they can be related to the group of non-transmissive plasmids while the bacteria themselves can be related to microbes that are devoid of the capacity for conjugation.

Precisely what induces conjugative activity?

First and foremost, induction is brought about by contact between cells of the opposite "sex". Receptors located on the surface that are identical to the receptors of the bacteriocins may be the apparatus that fixes and transmits the necessary signal inside the cells [62]. Incidentally, Reeves [62] feels that cell death as a result of bacteriocins can be viewed as the outcome of a superintense (paradoxical) reaction taking place on both sides of these receptors.

In other cases, conjugative activity is induced by a particular substrate. As Petit and his colleagues [63] have established, this type of induction is characteristic of the Ti-plasmids which confer oncogenesis on phytopathogenic microbes (Agrobacterium tumefaciens). Three classes of Ti-plasmids are known. Representatives of two of these encode the formation of the arginine derivatives octopine and nonpaline. Petit and his associates [63] noted that the transfer of these plasmids takes place only when cross-over occurs in the presence of these "opines".

Further studies have shown that the reason is not in the selective action of the opines which contribute to the appearance of transconjugates but in the direct induction of conjugativity. Based on this, the suggestion has been made that catabolite activity and the transfer function are under the control of the same regulatory genes. This assumption was successfully proven through the isolation of appropriate mutants. Still another indication, although not so direct, of the existence of combined regulation of catabolite activity and the transfer function is found in the work of Nakasawa and Yokota [64]. They described the TOL mutant for Ps. putida plasmids which determines the high constitutional activity for metapyrocatechase and the elevated and likewise constitutial capacity of the cells for conjugation.

Temperature may also be an inducer of conjugative activity. Thus, incubating the P^+ strains at 44.5°C prior to cross-over induced fertility in cholera vibrio of the El' Tor biotype and increased the yield of recominants in the case of cholera vibrios of the classic biotype [65].

The second aspect of the question of the distributional extent of extra-chromosomal elements is associated with the problem of their potential cosmopolitism.

In general, it is believed that there is a specific circle of hosts that is characteristic for every type of the extra-chromosomal inheritance factors. This is even reflected in the designated sexual factors: F-in the case of enterobacteria, P-in the cholera vibrios, FP in Bacillus pyocyaneus, K-in Ps. putida, Ti-in Agrobacterium tumefaciens, and so on.

The use of phages for purposes of taxonomy and strain typing is based on the postulate of specificity. However, the specificity of extra-chromosomal elements is not absolute. Data relating to the R-plasmids of the PI incompatibility group serves as the best proof of this statement [29]. On the other hand, the same can be said for a number of phages [60]. It is also appropriate to stress here that the range of hosts is generally broader for the universally induced phages than for phages that maintain a specific transduction. At present, it is difficult to state the true meaning of the ability to introduce foreign extra-chromosomal elements into the cells of any given type of microorganisms. However, without sequelae for the life-activity of cells, they would be unstoppable. In a natural setting, no one species of bacteria is in isolation from other microbes but, rather, forms a close community with them. It exists in a community with other microbes and the paths of its evolution depend on it as well. It follows then that the genetic exchange between any given type of microbe and other micr-organisms must play a specific and positive role in this process which leads to the appearance of micro sub-species [66] or ecotypes [67]. By the same token, the intra-species exchange of genetic information aided by extra-chromosomal factors can hardly be unlimited. If this were the case, there would be no discreteness of forms and any delineations between them would gradually disappear. For the reasons pointed out, we cannot agree with Reaney's opinion that the concept of species is less applicable to the members of soil-borne associations. Incidentally, based on information as to the existence of intra-species exchange of genetic information via extra-chromosomal factors of inheritance and the potential scale of this concept, Jones and Sneath [68] have proposed the term "genoform" referring to micro-organisms grouped on the basis of their ability to exchange genes. The term "genoform" is a contradistinction to the concept of "taxoform", that is, the concept of species in the standard taxonomical sense.

On first glance, the volume of genetic information transferred by extra-chromosomal elements seems small. However, the inadequancy of such a glance becomes obvious when we think about the existance of a vast number of different plasmids which is increasing year after year [26] and the ability of a number of plasmids to interact with the chromosomes of their hosts. Thus, Low [25] had reported only on the existance of 171 F'factors while we [29] had collected numerous data ast to the transfer of various genes by the R plasmids. In the case of the universally inducing phages, virtually every one can be "atomized" in the form of pseudo-virions by the cell gene of their hosts. Based on this and other experimental data, Reaney [60] came to the conclusion that the amount of DNA in the enterobacteria that can be transferred by extra-chromosomal elements is equal to or exceeds the volume of DNA in their own genophores. We, in turn, see no reason not to consider the transfer of the same volume of genetic information to be a possibility in a number of other microbes.

Everything that has been said: the extent of the distribution of extra-chromosomal elements and the volume of genetic information circulating in ecosystems with their aid--confirms the conclusion as to the role of extra-chromosomal elements in the life-activity and evolution of bacteria. A diagram (Figure 1) is given below that illustrates this conclusion in the model of enteric bacilli. We note that the diagram should be supplemented if only by those symbols that will properly pass on plasmids to the cells (resistance to antibiotics, colicineogeny, toxicogenesis, lysogeny, etc.).

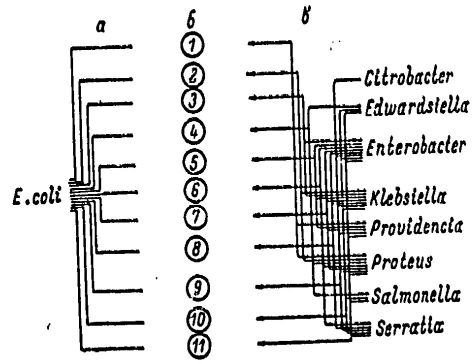

Figure 1. Genes which are absent in the chromosomes of the majority of Escherichia coli strains that can be transferred to them by means of phages and plasmids from other types of bacteria.

a-recipient, b-genes, c-donor. Phenylalanine: 1-desaminase, 2-urease, 3-enzymes for the utilization of malonate, 4-sulfite reductase, 5-enzymes for the utilization of adonitol, 6-enzymes for hydrolysis of gelatin, 7-enzymes for the utilization of inositol, 8-enzymes for the formation of acetone and 2, 3-butandiol, 9-enzymes for the utilization of citrate, 10-lysine-decarboxylase, 11-proteins to form flagellae (after Reaney [60])

Reaney's hypothesis on the origins of extra-chromosomal factors

Just how did extra-chromosomal factors of inheritance originate? Up until recently, we could only guess about this [1, 31, 36, 38, 40, 47, 69]. This situation has now changed somewhat with further successes in the field of molecular biology making no mean contribution. By way of summary, Reaney [60] has attempted to establish an "integrative theory of evolution". As a justification for this concept, he has utilized information as to the existence of serial continuity—either direct or inverted--in the DNA [34, 70-73]. The basic postulate of Reaney's hypothesis is the modular nature of the structure of favored genomes which insures the possibility for an easy exchange in the functional blocks of DNA which can take place inside the cells as well as between them where there exists an effective mechanism for gene transfer. It is necessary to add here that the exchange of large DNA blocks takes place regardless of whether there is genetic homology ("additional recombination" according to Schwesinger [71] or "integrative recombination" after Shapiro [34]).

The tandem duplication of separate portions of the DNA is apparently a special occurrence. It may be intensified as a result of mutagens and possible under the influence of environmental factors. In one way or another, however, duplication causes a disbalance in the genetic organization of cells in that the duplicated segments are unstable and their presence increases the probability of reciprocal cross-overs in the areas of homologous repetitions. It is during this process that Reaney believes the formation of circular mini-molecules of DNA, i.e., the various extra-chromosomal replicons, takes place. Similar extra-chromosomal replicons can fuse with the DNA fragments restricted by the IS-elements thus providing a start for a vast number of autonomous factors carrying favored genes either individually or in complexes.

According to Reaney's hypothesis, this is how the formation of extra chromosomal elements takes place up to now. To some extent, recent information on the generation of new closed DNA molecules during the process of recombination among the various plasmids [74-77] or during their incorporation into the chromosomes [78, 79] can be used to prove it. The results of experiments demonstrating the ability to form new autonomous genetic structures--converting phages with the direct involvement of transposones [80-82] provide further confirmation. It is interesting to note that the RSF1010::TnA plasmid obtained experimentally appeared identical to a plasmid isolated from clinical material, that is, a "natural" plasmid [83].

Based on the findings on integrative recombination, Shapiro [34] has put forth a thesis that is close to Reaney's postulate: the finding of the mechanisms of integrative recombination associated with moderate phages and other IS-elements is indicative of the presence of a new course of evolution in the chromosome structures of both prokaryotic and eukaryotic organisms.

As Reaney suggests, one of the main successes in evolution would have to be the discovery of an effective means of transferring genes from one cell to another during the early and middle Cambrian periods. The basic divergence in evolution probably occurred earlier during the pre-Cambrian era. A single phylogenetic line encompassing the original prokaryotic forms reduced the size of the genomes so as gain an advantage from an increased rate of reproduction. However, as soon as this was achieved, all the genes were represented in the form of a single copy. The paradox occurred: the need to acquire some new function was then confronted with the agsence of "free" genetic material. The answer to this was the distribution of extra-chromosomal factors (phages and plasmids) with a wide range of hosts that would allow the then prokaryons to adapt rapidly to any sort of changes in the conditions of the external environment. Although many of the extra-chromosomal elements merely "reshuffled" genetic information among various forms of bacteria, the elasticity of the federation of cells and extra-chromosomal factors gave cells advantages which overcame the mutations they generated. At this time, apparently, the most diverse extra-chromosomal factors possible occurred, although two types were especially fortunate—the phages and plasmids which have endured until now*.

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*Later discussions by Reaney relate to a second phylogenetic line--the eukaryotic cells. Various extra-chromosomal elements [1, 2] are also inherent for them although the question of these elements goes beyond the framework of this project.

In assessing the role of extra-chromosomal factors of heredity in the life of bacteria, the views of Reaney coincide for the most part with those held by other authors. Ashmarin [84] assumes that for populations of bacteria, the existence of some portion of the substance of heredity in the form of mobile, easily transmitted instructions is advantageous. They encode the synthesis of systems that will be needed by the bacteria relatively rarely but whose absence might "suddenly prove fatal for the population as a whole". In I.P. Ashmarin's opinion, herein lies the initial form for the division of functions among populations of bacteria which makes them more viable and, at the same time, prevents overloading of the cells with genetic material and certain synthetic and regulatory systems. We have even written essentially the same thing [29] with reference to Clowes [24].

The idea that extrachromosomal elements can play the role of a "reserve genetic fund" aggrees with numerous finding as to the regulation of chromosome size during the process of evolution as well as with information as to the loss of unneeded genes [2].

The origin of r-determinants and other specific plasmid genes

We have yet to discuss the question of the origin of the non-transmissive plasmid determinants which define their specifics. This is best done in the model of the r-determinants and to remember that soil microorganisms are the primary producers of antibiotics. It is natural, therefore, that the concept of soil microorganisms as the sources of genes for resistance in general and transmission in particular occurred some time ago. It is no wonder that R plasmids have been found in bacteria from soils in geographic regions where antibiotics have not yet become widespread or remain totally unused [6, 7, 9]. The fact that soil microbes can be a source of r-determinants has withstood confirmation in the work of Benveniste and Davis [85]. They were the first to show that enzymes from certain antibiotic producers which modify (inactivate) aminoglycoside preparations are similar to analogous enzymes encoded by the R plasmids. A similar conclusion is found in other works by Davis and his colleagues [86, 87]. On the other hand, we know of bacteria of other biotypes whose resistance to various antibiotics is also a species characteristic. These include in particular Proteus mirabilis which is resistant to tetracyclines and chloramphenicol and Bacillus pyocyaneus which is distinguished by its resistance to a number of antimicrobial agents [7, 88, 89]. However, the mechanisms of the "natural" resistance of these bacteria to antibiotics is frequently differentated from the mechanisms of stability determined by the R plasmids [9, 31, 39, 85, 86, 90-92]. Nevertheless, the tendency to associate the origin of the r-determinants of the R plasmids with the chromosome genes of bacteria that have a natural resistance to antibiotics appears well founded. As Davis and Rownd believe [93], some of these genes may not have initially had any direct relationship to resistance. On our part, we would add that the information available now can hardly cover all the potential mechanisms for the inactivation of anti-microbial agents. Information on new mechanisms is still waiting to be discovered [94]. It may be anticipated that, sooner or later, additional facts will help to fill in the gaps in information on the mutual relationships of the "plasmid" and "chromosomal" types of resistance.

The notion that soil-borne or some other type of microflora might have initially been the source of genes for resistance occasionally meets with objections. The basic argument is the lack of information as to capacity for direct genetic exchange as between actinomycetes and the enteric bacilli, for example. While this is true in general, it is also not possible to exclude indirect exchange based on the principle of "damming" when it takes place with the involvement of a number of bacteria-intermediaries [29, 60, 68, 86, 95]. Davis and his colleagues [87] demonstrated recently that the gene for neomycin-phosphotransferase in Bacillus circulans can function in the cells of an enteric bacillus, that is, in a typical representative of the gram-negative microbes.

Two hypotheses have been put forward to explain how the genes for resistence make (or have made) the transition to an autonomous state and how they acquire transmissiveness.

The first of these [39] proceeds from the concept that the various transformed extra-chromosomal elements--the factors of transfer, moderate phages and cryptic plasmids--are incorporated into suitable loci of bacterial chromosomes as stipulated by Campbell's model [41]. In the subsequent incorrect excision, the chromosomal genes appear to have been incorated into the substance of one extra-chromosomal element or another and, in addition appear to be "escaping to freedom". In essence, this hypothesis is built on analogies with the finding pertinent to the formation of F'-factors and phages that are capable of carrying out a specialized transduction [29, 96]. In the opinion of Watanabe [10, 11, 39], some as yet unknown microbe could be a universal gene donor.

The process of "snatching" genes may take place one-by-one in series or all at once in the form of several contiguous genes which, in the final analysis, also results in the appearance of plasmids with a multiple drug resistance factor. In turn, the R plasmid once formed can ultimately dissociate with the free transfer factor and the r-determinants (that is, the non-conjugative R plasmids). Occasionally during the decomposition of the R plasmids, the transfer factors maintaining the physical association with the various determinants, generally with the gene for resistance to the tetracyclines, while the other genes are lost ("segregation"). In both instances, however, they are free to recombine again with the chromosomes which results in the formation of new R plasmids. The dissociation process for the R plasmids clearly occurs most often in the cells of heterologous hosts [15, 97].

The diagram (Figure 2) illustrates the foregoing very well.

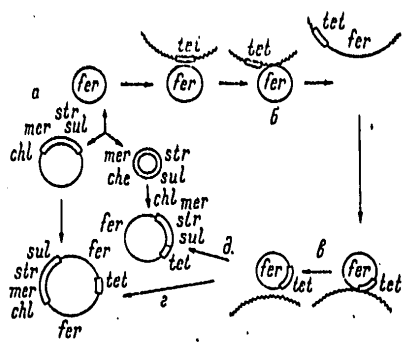

Figure 2. Diagram of integrative recombination with inclusion of a chromosomal gene into a plasmid (cited from Tshëpe and Rische [7]).

a-dissociation of the type f^+ R plasmid to the transfer factor (fer) and r-determinant (non-conjugative R plasmid); b-inclusion of the transfer factor into a chromosome from Proteus mirabilis near the tet-gene; c-incorrect "splitting" of the transfer factor with pick-up of the tet-gene; d, e-formation of new R plasmids carrying the tet-genes in addition to other genes for resistance. Shaded lines represent the P. Mirabilis chromosomes

A sizeable volume of experimental data indirectly confirming Watanabe's hypothesis has been built up to date [7, 39]. The ability of a wild-type R plasmid to carry a lactose appendage [98] in addition to other genes for resistance can be included here.

The second hypothesis which has acquired extensive popularity is based on information as to the existence of "migrating" elements (transposable elements [35]). Among these, the Tn-elements, or "transposons" [34, 60, 70-72] are of the greatest interest in this context.

The structure of a transposon can be visualized as a gene for resistance or other-structure gene with both ends limited (flanked) by IS-elements. The terminal DNA series are inverted in relation to each other in the overwhelming majority of transposons. Transposons "jump around" from replicon to replicon, from a plasmid to a chromosome [99, 100], to other plasmids [83, 101-104] or to the genomes of moderate phages [105-108]. By now transposons have been discovered that carry genes for resistance to the penicillins, streptomycin, and tetracyclines, chloramphenicol, kanamycin, the sulfonamide drugs, trimetroprim and mercuric chloride; that is to the antimicrobial agents to which transmissive resistances is most often found in bacteria. It is important to stress that the inclusion of transposons in any one replicon does not depend on the state of the rec-system of the host. The process shown by this ("integrative recombination) differs substantively from homologous recombination [34, 71].

Many investigators feel that the occurrence of R plasmids per se is associated just the the presence of transposons. This hypothesis does a good job of explaining the aspect of the problem of drug resistance as well as the plasticity of bacteria--their rapid adaptation to new antibiotics and the loss of indicators that have become unnecessary (Figure 3). Only one thing remains unclear—the origin of the transposons themselves.

We have frequently referred to the IS-elements which are related to the number of obligate components in the genetic apparatus of cells. Now, we will show that their role in the formation of conjugative R plasmids may lie in their ability to combine the factors of transfer and the r-determinants into a single structure. In addition, they may also be directly involved in regulating the activity of genes [109].

As to how the specific determinants of other plasmids occur, we can only theorize. An analysis of facts such as information on the new transposon Tn 951, which carries not the genes for resistance but a lactose appendage [110], on the shifting of chromosomal genes into an autonomous condition [111-116], on the formation of conversion phages of the "omicron beta" type [117] and on the existence of lysogenous strains of pseudomonads with a transmissive characteristic for toxicogenesis [118], etc. can provide the information needed for purposes of speculation.

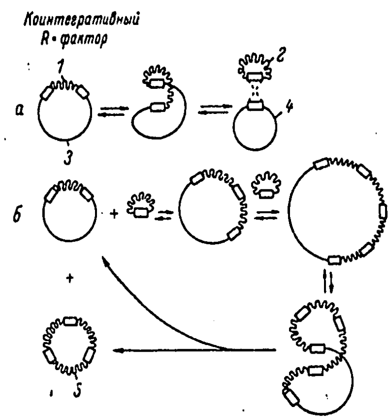

Figure 3. The presume mechanism for reverse dissociation of the contegrated R plasmids at the sites of IS1-element inclusion

In the diagram—formation of the independent transfer factors, the r-determinants (a) and polygenic r-determinants (b) (after Cohen and Kopecko [70]). Further explanations are in the text. 1-R-determined component, 2-R-determined replicon, 3-R-component, 4-RTF replicon, 5-multiple R-determinant plasmid

Conclusion

The problem of the origin of the extra-chromosomal factors of inheritance should be solved from general biological points of view and with the necessary consideration for the role of these factors in the life of the cell-hosts. It is obvious that extra-chromosomal elements have as ancien an origin as bacteria and probably lie with overall evolutionary roots. It is not possible to draw a clear distinction between the various extra-chromosomal elements. It is also difficult to differentiate them from other components in the genetic apparatus of cells. Special attention needs to be given the questions of simulating the extra-chromosomal elements of various types in vivo and in vitro experiments and the mechanisms for the control of their phenotype expression. There should also be major efforts made to find the means for the exchange of genetic information between microbes included in different taxons. The information that we have presented in indicative of the fact that the extra-chromosomal elements of heredity apparently play the role of the basic force in the evolution of microbes in accord with the principles of expediency and rationality in nature. Resolving the issues associated with these elements in any one age can provide a framework for the speical problem of microbiological genetics and open the way for explaining the laws of inheritance in evolution in the general biological sense.

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